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CLINIC OF DR. ARTHUR DEAN BEVAN

PRESBYTERIAN HOSPITAL.

SURGERY OF THE SPLEEN

I DESIRE to present to you at this clinic the subject of surgery of the spleen. I shall operate upon 2 cases, in one of which we have made the diagnosis of splenic anemia, and in the other we have made a diagnosis of hemolytic jaundice, and shall have the opportunity of showing you several spleen cases that happen to be in the hospital at this time. I shall make these the basis for a brief discussion of the present status of surgery of the spleen. Before operating on the first case and while it is being prepared I shall tell you a few facts in regard to the history of the surgery of the spleen.

There is a myth in medical history that the ancients operated upon the spleen and removed the organ for the purpose of improving the wind of men who ran long distances, like Marathon races. There seems to be little real foundation, however, for accepting these cases as real. The myth had, however, very wide vogue, and is found not only in medical literature, but is quoted by Shakespeare and a number of the old authors. It is probably true that there have been occasional cases of removal of the spleen done by some of the old surgeons several centuries ago, especially in cases of large incised wounds of the abdomen and thorax with protrusion of the spleen through the wound. There are several quite well-authenticated cases in which the attending surgeon tied off the pedicle of the spleen and allowed it to separate, with complete recovery of the patient. When I was a medical student in the early eighties there had been 20 or

30 cases of splenectomy done and reported in the literature, with a mortality of about 50 per cent. In 1900 the number had grown to between 250 and 300 cases. In the last twenty-five years the number of operations done on the spleen has increased very rapidly, so that one clinic, the Mayo Clinic, has been able to report something more than 300 splenectomies.

I want to say a word in regard to the physiology of the spleen. This will necessarily be very brief because our best physiologists are quite frank in stating that we do not as yet understand the physiology of the spleen. The most important fact which has been quite definitely demonstrated is that an individual can live without a spleen, and that whatever the functions of the spleen are after removal of the spleen they can be assumed by other structures, such as the lymphatic glands, possibly the liver, the bone-marrow, and other structures.

The first patient on whom we shall operate this morning is a girl of twenty years, who has been under my observation for a year or more. She has known for several years that she had an enlarged spleen. She consulted me first in the spring of 1923 At that time, in addition to the enlarged spleen, she had 49 per cent hemoglobin, about 3,000,000 R. B C, and about 8000 W. B C. The attending physician, Dr Woodyatt, regarded the case as one of splenic anemia and thought that the question of removing the spleen should be considered. He felt that a splenectomy should be done before any secondary changes, leading to an outspoken Banti, had occurred The patient had had an attack of grip last spring, was rather run down, and I advised that she be kept out in the sunshine and fresh air until she had improved in her general condition We also agreed to give her some moderate x-ray treatments She improved considerably and came back early this spring with a hemoglobin of 72 per cent, W B C. 11,000, and R B C 4,000,000 The spleen did not seem to have diminished very much Two or three months ago she had her first definite evidence of hemorrhage, two rather severe nosebleeds, which had to be controlled by packing Her general condition has been fairly good She has been studying in one of our state universities and has been
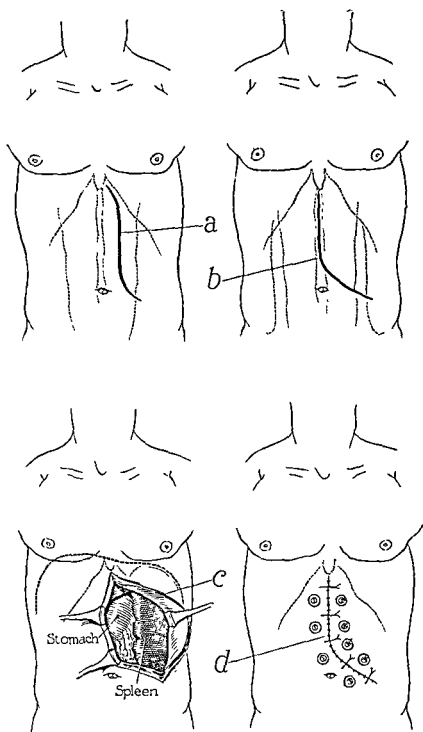
Fig. 365.— *a*, Bevan splenectomy incision. *b*, Incision employed in Case II for splenectomy. *c*, Abdominal exposure through retracted incision. *d*, Wound closed with button suture in addition to usual abdominal closure.

able to carry on her work without any difficulty. I finally
agreed to wait until she had finished her college year and do the
operation the first part of her summer vacation.

She comes back to the hospital now with a hemoglobin of
70 per cent , W. B C. 9000, and a little over 3,000,000 R. B. C.
On deep inspiration her spleen comes down three or four
inches below the costal arch. We shall operate under gas and
ether. The patient is now ready for laparotomy. I shall make
in this case an S-shaped incision beginning in the angle between
the ensiform and the costal cartilages on the left side, passing
parallel with the costal cartilages for 2 or 3 inches, and
then passing down over the middle of the rectus to a point about
opposite the umbilicus, and there, as you see, I sweep it down and
outward across the rectus muscle. I may be able to do the
splenectomy without dividing the rectus muscle, but if it is
necessary to obtain a full and complete exposure I shall not
hesitate to divide the rectus muscle at the lower end of the
incision. After dividing the skin and superficial fascia I split
the rectus at about its center and then divide the posterior
sheath of the rectus and then the peritoneum. On entering the
peritoneal cavity I find the spleen is fixed pretty high up and that
it will be difficult to obtain a complete exposure without dividing
the rectus, and as I do this you see that it gives a very much
more complete access to the spleen and its pedicle and to the
diaphragm. I ligate the vessels of the hilum separately, taking
care to avoid injury to the tail of the pancreas, which is just
beneath the central portion of the pedicle. As I draw the spleen
into view, you see that there is a separate mass of splenic tissue,
about the size of a large prune, at the upper pole of the spleen
which is almost completely separated from the rest of the spleen
tissue. I have now completed the division of the pedicle, ligated
all the vessels and divided the pedicle distal to the ligations, and
am able to lift the spleen out of the abdominal cavity. Pads and
sponges all accounted for. I close the abdominal incision by
first closing the peritoneum and then suturing the divided rectus
muscle together, then close the rest of the incision in the usual
way, except that I add four sets of large button sutures, which

give a very complete fixation to the wound. The patient is in very good condition at the close of operation, and I shall order 1/6 gr. of morphin as soon as she wakes up, and for the first twenty-four hours 8 ounces of normal salt solution by rectum.

Fig. 366 —Showing individual ligation of splenic vessels and cutting of pedicle. Insert *A* shows tail of pancreas pulled up with splenic pedicle.

Postoperative History.—Patient made a very good recovery from her operation. The wound healed primarily without any infection. The only complication that arose was the occurrence

of two small lung infarcts, which took place on the fifth and eighth days after the operation, associated with pain, a little friction, and a short sharp rise of temperature to 102° F. Within about four weeks the blood condition had improved until it was practically normal

The second patient upon whom we shall operate this morning is a boy of fifteen who comes to us with the history of having all his life had a rather jaundiced tinge, two or three times a year this jaundiced tinge would deepen, and concomitant with this increased jaundice the patient would have an attack in which he would have marked weakness, so much so that he would remain in bed for a week or ten days and would have some temperature. In addition to these facts, the boy has a very definitely palpable spleen which projects 4 or 5 inches below the costal arch and comes almost to the middle line, extending down as far as the umbilicus. The father of the boy states that there are several members of his wife's family who have had similar clinical pictures, none of whom, as far as he knows, however, have had any surgical operations. The hospital history shows the following facts:

This patient, a male aged fifteen years, entered the hospital because of an enlarged mass in the upper part of the abdomen, shortness of breath on exertion, and a yellow tinge to the skin and sclera. The mass in the abdomen was noticed first in November, 1923; it has caused no pain or other subjective symptoms and is regarded as more or less irrelevant. It has not increased in size the patient thinks. Jaundice was noticed at the same time and, according to the father's story, has been present since childhood. The boy always had been weak and never could play as vigorously as other children.

Past history reveals the fact that the patient has been subject to one or two sick spells a year during the past four years. At such times he was nauseated, vomited, and had severe pain in the splenic region as well as the lower abdomen. The attacks of pain frequently lasted fifteen minutes to an hour, and during such times the patient's temperature was elevated, in one instance to 105° F.

Physical Examination.—This was essentially negative, with exception of the following: Spleen enlarged, extending from posterior axillary line anteriorly to within 2 cm. of midline and from above the costal margin almost to the level of the crest of the ilium. It was movable on respiration. The surfaces were smooth and firm. Spleen lay anterior to colon. There was no abdominal tenderness or ascites.

Liver.—Slight enlargement. Jaundice present. Feet were swollen and patient stated that he had a constant tingling sensation in them.

Heart.—Slight aortic diastolic murmur of aortic insufficiency. A letter from the patient's family physician disclosed the fact that on Agust 30, 1924 the blood-picture was: Hb., 70 per cent.; R. B. C., 4,480,000; W. B. C., 12,000; polymorphonuclears, 62 per cent.; lymphocytes, 38 per cent.

He also stated that the spleen had apparently not enlarged greatly since his preceding examination in November, 1923.

Laboratory Examination.—Hb., 77 per cent.; W. B. C., 11,600; R. B. C., 3,008,000; color index, 1.2 plus; blood-pressure, 140/60; polymorphonuclears, leukocytes, 68 per cent.; small mon., 30 per cent.; large mon., 2 per cent.; clotting time, seven minutes (coagulometer).

There was a slight variation in the size of the red cells, otherwise no change.

On questioning the boy about himself one is impressed with the statement which he makes, first, that he has been very different from other boys, especially in this, that he gets out of breath, he has no endurance, he cannot play ball or football for any length of time as his comrades can. The boy is mentally bright and his general condition is good. The picture is a perfectly typical one of hemolytic jaundice, and I have recommended to the father that we remove the spleen on the basis that splenectomy has proved to be curative in almost all of these early cases of hemolytic jaundice, that the blood-picture has cleaned up, the jaundice has disappeared, and the patient has been placed in a position where he has very much more vigor and can do the ordinary things that are required in active life. Fortu-

nately, too, splenectomy in these cases has been accompanied by
very small risk.

The patient has now been prepared. He has been put to
sleep with gas, oxygen, and ether, and we shall proceed to do the
operation. The incision which I shall make in this case is one
which I have been experimenting with for some time. It seems
to me to be in some ways the best that I have yet employed in
these splenectomy cases For some time I have been using an
S-shaped incision over the left rectus muscle, as you saw in the
first case, but in this case I shall modify this, and have made an
incision from the ensiform cartilage down almost to the umbilicus
in the midline I then curve the incision out just above the
umbilicus transversely across the rectus muscle and divide the
rectus muscle completely and for a short distance, say an inch
or more, *the three flat muscles of the abdomen, the internal and
external oblique, and the transversalis* You see as we carry out
this incision we are enabled to raise up a very large flap of the
abdominal wall and expose the spleen very completely, the
pedicle of the spleen, and the under surface of the diaphragm
The spleen in this case, as you see, is about 10 inches long and
about 7 inches from side to side and possibly 4 inches in its
greatest thickness. There are no adhesions about the spleen
in this case fortunately, and I can lift the spleen out of the
external incision and bring into plain view the large broad
pedicle You can see the great vessels, the arteries and veins
which run between the layers of the peritoneum to the hilum of
the spleen I shall ligate these vessels separately. I think it is
very bad practice to attempt to ligate these vessels en masse.
The entire pedicle, as you can see as I am ligating it, is probably
6 inches broad and it is necessary to ligate the ten or twelve
vessels separately. In doing this I want to call your attention
to the structure which is beneath the central portion of the
pedicle which now comes in view and which is the tail of the
pancreas One of the risks in doing splenectomy is injury to the
tail of the pancreas. Sometimes ligation of the tail of the pan-
creas has given rise to no trouble. On the other hand, there is
always the risk that injury to the pancreas will be followed by

fat necrosis due to the introduction of the pancreatic fluids in the surrounding tissues. Having ligated the pedicle I now come to the attachment of the spleen to the diaphragm and here I find two reflections of the peritoneum. I divide these reflections and I am now able to free the spleen completely and lift it out of its bed. I now look carefully over the ligated vessels and see that we have controlled all the hemorrhage and that we have not injured the pancreas. I make closure of the abdominal wall without any drainage. The patient is in very good condition at the close of the operation. The pads and sponges have all been accounted for.

POSTOPERATIVE COURSE

The spleen measured 23 by 11 cm. and weighed 760 grams. The surfaces were smooth, soft, and dark reddish purple, and surfaces made by cutting were dark reddish purple. Microscopic sections showed splenic tissue apparently without any marked fibrosis or changes in the reticular or endothelial structures. There was some diminution in the number of lymphoid follicles as well as the total number of lymphocytes distributed in the tissue. In one or two places it seemed that multinucleated endothelial cells were present, and in others there were appearances of fragments of red blood-cells lying in the cytoplasm of the endothelial cells, but both latter findings are doubtful.

Postoperative Course.—Patient went on to an uneventful recovery.

Postoperative Laboratory Findings.—December 2, 1925: Fragility test (one hour). Hemolysis begins 0.46 per cent. NaCl. solution. Hemolysis complete 0.36 NaCl solution. Control hemolysis begins 0.42 per cent. NaCl solution Control hemolysis complete 0.32 per cent. NaCl solution.

Blood-picture.—Hb., 98 per cent.; W. B. C., 11,000; polynuclears, 44 per cent.; small mon., 40 per cent.; transitional, 1 per cent.; eosinophils, 3 per cent.; basophils, 3 per cent.

Red cells appear normal.

The next patient whom I shall show you is one on whom I operated some time ago. She is the wife of one of my medical

colleagues. She had some very severe hemorrhages following the birth of her first child. Her life was saved only after a very hard fight. Repeated blood transfusions were necessary and she eventually made a recovery, but remained in a weakened condition for a good many weeks Examination showed that she had a splenic anemia The internist under whose charge she was at the time placed her on x-ray treatment and general medical treatment with the hope that she would not require any operation She became pregnant a second time and on very sound advice, I think, she was aborted. *Within a few weeks I saw her in consultation* The picture was quite clearly that of a marked but fairly early splenic anemia without as yet any definite involvement of the liver and without any evidence of perisplenitis or ascites. After studying the case carefully we all agreed that the safest and best plan was to remove the spleen before a well-developed Banti's disease had become established. Her hospital record is as follows

Mrs. B., age twenty-eight, married, first entered the hospital August 14, 1922 complaining of evening rise in temperature and a tumor mass in the left upper quadrant of the abdomen and the left kidney region. During the preceeding June the patient had had several teeth extracted and this had been followed by an osteomyelitis of the jaw. Almost immediately after that had cleared up she noticed an evening rise in temperature and had consulted a doctor in regard to her lungs He had ruled out tuberculosis. Two weeks prior to admission she had noticed that her waist line was becoming increasingly larger, and had gone to a physician at that time for examination. A tumor mass was felt in the left kidney region, and upon further examinations an enlarged spleen was thought to be definitely excluded

Physical examination revealed an undernourished young woman of about twenty-eight, not acutely ill. There was a large, firm, smooth, movable tumor in the region of the left kidney.

Laboratory examinations showed the following

Hb., 80 per cent, R B. C., 4,790,000, W B C., 7200; blood-pressure, 120/72, Wassermann reaction negative. Differ-

ential kidney function test: right, 24 per cent, left, 17 per cent.

Skiagrams showed a normal kidney shadow on the left side, while that on the right could not be definitely made out. Pyelograms of the left kidney were normal with the exception of a somewhat club-shaped superior calyx. One of my colleagues operated upon her, with the clinical diagnosis of a kidney lesion.

The left kidney was exposed through a lumbodorsal incision and was found to be normal, after which the peritoneum was opened and the spleen brought into the incision. This organ was much enlarged and definitely nodular. The incision was closed and the patient went on to an uneventful recovery, after which she was immediately transferred to a medical service for further study. There the colon was inflated with air and the spleen was found to override the large intestine. An analysis of the blood at that time confirmed the tentative diagnosis of a splenic anemia, and the patient was discharged under appropriate treatment.

In the meantime Mrs. B. had become pregnant and again entered the hospital on April 4, 1923 for confinement. The next day she delivered a normal baby girl. Her postnatal convalescence was complicated by profuse, uncontrollable postpartum hemorrhage, which brought her hemoglobin down to 20 per cent. Her blood-picture at this time follows:

Hb., 20 per cent.; W. B. C., 3000; R. B. C., 950,000; blood-pressure, 98/40. Poikilocytosis, anisocytosis, nucleated red cells present. Microcytes, macrocytes, macroblasts present.

In time the patient recovered and was sent out of the hospital in good condition, only to return seven months later again pregnant. At that time she was therapeutically aborted.

In December, 1923 the patient returned to the hospital, this time for a splenectomy, and was admitted on a general surgical service. Operation was performed on December 22, 1923, through a Bevan S-shaped incision on the left side, and the spleen exposed. It was found to be much enlarged and adherent to the dome of the diaphragm at its upper pole by dense fibrous adhesions.

Pathology.—The spleen weighed 885 grams. The serosa was smooth, shining, and normal in appearance, with the exception of the area at the upper pole, where the spleen had been attached to the diaphragm The spleen was normal in consistency with the exception of a place 2 by 5.5 cm., which was cystic The capsule stripped easily and left a smooth surface. The surfaces made by cutting were uniformly bright red, moist, flat, and homogeneous The malpighian corpuscles do not stand out. Reticular elements were not intensified, and the splenic pulp was rather friable.

The patient went on to an uneventful recovery and was discharged on January 18, 1924

We recently had a third case in the hospital with a tragic history. About ten years ago a young girl was brought to my service with an abdominal tumor filling the lower right side of the pelvis which could be outlined by a bimanual made with the fingers in the rectum and the hand above the symphysis. No further diagnosis could be made at that time than that of an abdominal tumor, and I proceeded to make an exploratory laparotomy. I found a mass filling the right lower quadrant of the abdomen and pelvis, and when I freed this mass from the adhesions which bound it in position I found it was a displaced spleen which had become adherent in the pelvis. I removed the spleen without any difficulty, ligated the long pedicle, and the child went on to a very normal and complete recovery. About a year ago she married, became pregnant within a short time, and was brought to the hospital She complained a great deal of abdominal distress as the uterus expanded and as the months went by, due, I have no doubt, to the very extensive adhesions which were due to the old operation and the pathologic condition making it necessary She went on to term, however, and about two weeks ago gave birth to a healthy child after a rather severe labor It seemed as though she would go on to recovery, when she suddenly died of pulmonary embolism.

I desire to report another case of splenic anemia in which the hemorrhages recurred even after a splenectomy.

Miss R. H , age fifteen, entered the Presbyterian Hospital

on December 28, 1921 because of hemorrhage from the stomach and bowel. This patient had been entirely well until four years before, at which time she had numerous hemorrhages from the bowel and stomach. About 2 o,clock one morning she was awakened from a sound sleep and vomited a large amount of dark red blood and blood-clots. She was in bed for about four to six weeks, but after that was troubled no more with hemorrhages until two years later, when she had five or six gastric hemorrhages in a period of three days. Her stools were tarry. She has been progressing in about the same way until she came to the hospital on the above date. On the day of admission she vomited a quart or more of dark red blood; she was much weaker than at any time before admission, and continued to have bloody stools frequently during the day.

Physical examination revealed a poorly nourished young female, not acutely ill, but very weak and anemic looking. Otherwise the examination was negative with the exception of an enlarged spleen which was palpable one finger's distance below the right costal margin. The liver was not palpable.

Laboratory examination of the blood showed Hb, 68 per cent.; W. B. C., 11,400; R. B. C., 3,760,000; small mononuclears, 26 per cent.; large mononuclears, 1 per cent.; large lymphocytes, 8 per cent.; transitional, 4 per cent.; polymorphs, 61 per cent.

A diagnosis of splenic anemia with gastric hemorrhages was made.

The patient was in such poor condition that no attempt was made to remove the spleen at the time patient first entered the hospital, and she was carried along on medical management, with frequent blood transfusions, until May 20, 1922, at which time a splenectomy was done. The patient recovered rapidly from this operation, and without any complications, and was discharged as cured on June 10, 1922, entirely free from recurring hemorrhages and much improved in every way.

Less than a year after her discharge from the hospital the patient again entered, February 24, 1923, because of a lateral sinus thrombosis. On admission her blood-picture showed Hb 97 per cent.; W. B. C., 22,900; R. B. C., 5,010,000; blood-

pressure, 104/54; small lymphocytes, 4 per cent.; large lympho-
cytes, 4 per cent , polymorphonuclears, 91 per cent.; eosinophils,
1 per cent. The patient was operated upon and went on to an
uneventful recovery, being ready for discharge on May 26, 1923.

In January, 1924 the patient again returned to the hospital.
She had felt well until two days prior to admission, at which time
she noticed that her stools were loose, watery, and dark She
had vomited a washpan, two-thirds full of dark red blood and
some fresh blood, and was rather weak, but not so weak as im-
mediately following her preceding gastric hemorrhages Blood
count on admission was Hb., 70 per cent., R. B. C., 2,820,000;
W. B. C., 2250, color index, 1.12. The patient continued to
have numerous gastric hemorrhages, with nausea and vomiting
of dark red blood, for the next ten days or so, while the stools
continued to be tarry for about two weeks After that time
the patient improved somewhat, and was discharged from the
hospital, under management, on January 22, 1924

Within the last ten years a great many splenectomies have
been done along two other lines, one in connection with per-
nicious anemia and one in connection with leukemia As a
matter of fact, many leukemic spleens have been operated on,
some of them years ago. In the first 20 cases of spleen that I
can find in the literature 8 of them were done for leukemia and
all of them died I can remember very well when Dr Maurice
Richardson reported to the American Surgical Association
about twenty years ago the first successful splenectomy for
leukemic spleen. Since that time a great many cases have been
done and as a demonstration of the great improvement of the
technic in splenectomy I might cite the fact that in the Mayo
Clinic, where they have done such a large number of splenec-
tomies, they have succeeded in reducing the mortality of splenec-
tomy, even for leukemic spleens, well under 10 per cent.

The effort made to cure cases of pernicious anemia by sple-
nectomy has not, to my mind, been at all successful. This work
has been a piece of research which has been warranted in the
effort to cure this otherwise *incurable condition The results,*
however, do not to my mind, justify the continuance of sple-

nectomy as a treatment for pernicious anemia. I believe that the same statement should be made in regard to splenectomy for leukenia.

I feel that we can divide the surgery of the spleen into two quite definite groups, one in which a very considerable experience has demonstrated that splenectomy is of service, and these cases include ruptured spleen, misplaced spleen, splenic anemia, and hemolytic jaundice. In the other group in which I feel that our experience has demonstrated that splenectomy is not worthwhile and should be discontinued, we find leukemia and pernicious anemia. There is one very important moral I think, and that is the most important moral that we can elicit from our study of the surgery of the spleen, namely, the importance of early operation in splenic anemia. So many of these cases are seen early with not very marked symptoms and at a time where splenectomy could be done with comparatively little risk and with a great deal of assurance of curing the patient. These very cases if allowed to go on without the benefit of operation almost invariably develop into outspoken cases of Banti's disease and perisplenitis with involvement of the liver, with ascites, and with conditions which go on to a fatal termination if left alone, and which make operative interference exceedingly dangerous from the standpoint of immediate mortality and rather hopeless from the standpoint of any permanent improvement.

CLINIC OF DRS. A. J. OCHSNER

AND

ERWIN R. SCHMIDT

AUGUSTANA HOSPITAL

GAS BACILLUS INFECTION ORIGINATING IN A GANGRENOUS APPENDIX

GAS bacillus infection following operation for gangrenous appendicitis is so rare and the outcome is so commonly fatal that it has seemed worth while to report the following case:

Mr. G. G. S., No. 80,182, came under our care at the Augustana Hospital on January 4, 1925, suffering from acute gangrenous appendicitis. He gave the following history: In 1899 he had internal urethrotomy performed for stricture. In 1913 a nephrolithotomy was performed for the relief of abscess of the kidney. In September, 1923 he began to suffer from symptoms of duodenal ulcer which subsided after the third day of treatment at Hot Springs, Virginia, where he remained for three weeks. Three weeks after his return and resumption of his business and regular diet his symptoms of duodenal ulcer returned. He was placed on an ulcer diet with milk of magnesia, which resulted in relief from all symptoms up to the time of admission.

About sixty hours before, he began to suffer from pain in the right lower quadrant which was severe, but not sufficient to prevent his coming to the hospital in an automobile and walking into the office for examination. He suffered from nausea with vomiting. His abdomen, which had a thick layer of fat, was distended with gas and there was dulness over the right lower quadrant. The temperature was 99° F., pulse 132, leukocytosis 29,800. In all other respects nothing abnormal was discovered.

An operation was made under local anesthesia with $\frac{1}{2}$ per cent. novocain solution, the patient having received $\frac{1}{4}$ gr morphin and 1/150 gr. atropin one hour before beginning of the local anesthesia and $\frac{1}{6}$ gr. of morphin and 1/200 gr. of atropin fifteen minutes before

Because of the evident presence of an abscess a right rectus incision was made   The abscess was shut off by the cecum and omentum, the latter not being adherent to the anterior abdominal wall   The intestines were carefully packed off with moist gauze sponges and the abscess opened by separating the cecum from the attachment to the parietal peritoneum   The pus, which was fetid, was carefully sponged away, leaving the cavity dry and apparently clean   The gangrenous appendix was ligated and removed   Five cigarette drains were placed in the pus cavity below the cecum and out of the lower end of the wound   Three tension sutures were applied because of the thickness of the abdominal wall   Peritoneum and transverse fascia, rectus muscle and fascia were sutured separately with catgut, and the skin with horsehair,

The patient seemed listless, but aside from that there were no alarming symptoms   Temperature and pulse were as follows. 99° F and 144.   The appearance of the wound was perfectly normal until the third day, when it appeared slightly edematous.   Upon removing the superficial sutures and separating the edges of the wound it was apparent that there was an infection of the fascia. All the sutures were removed and a typical gas bacillus infection involving the fascia of the entire wound was exposed   This had begun to undermine the skin, and accounted for the listless condition of the patient   The catgut sutures of the aponeurosis and those uniting the rectus muscle were removed, and the entire surface irrigated with peroxid of hydrogen   Then the surface was irrigated with a strong chlorin solution and the entire wound packed with gauze saturated with this solution   Four rubber-drainage tubes, tied at the distal ends with many small perforations, after the method introduced by Carrel in his application of the Dakin solution, were incorporated in the dressing.   The entire dressing was covered with a rubber sheet.

Fresh chlorin solution was forced into each tube with a glass syringe, every two hours night and day, for ten days and nights. Each day more and more of the necrotic tissue was dissolved, leaving the wound surface entirely clean on the twelfth day.

During the World War it was not unusual to meet cases of gas gangrene infection, but in civil practice it is a rarity. It has been described in the literature by Runeburg, Veillon, Bruger, Erlich, and others, so it is a condition to be kept in mind.

When the gas bacillus infection has been overcome the problem of closing the wound presents itself. During the time the infection is present the wound is opened as widely as possible so as to secure the best drainage. This is a wide gaping wound. In our case the peritoneum remained closed except for a small fistula which was kept open by a small piece of iodoform gauze, which was changed every other day. To clear up the secondary infection, after the wound had cleared itself of sloughing tissue, dichloramin-T was used. Tension sutures were put in to coapt the retracted skin margins, and small strips of adhesive strapped across the wound. As soon as the patient's condition permitted he was put into a warm bath daily. These warm baths helped greatly in promoting healing in such cases. After the wound has healed completely, secondary plastic work may be done after a sufficient length of time has elapsed to insure no lighting up of a dormant infection.

The interesting point in the case is the fact that, not withstanding the very extensive gas bacillus infection, the continuous application of fresh chlorin solution succeeded in destroying the infection.

CLINIC OF DR. CARL BECK

NORTH CHICAGO HOSPITAL

TWO CASES OF RARE BRAIN LESIONS

METASTATIC ABSCESS OF THE BRAIN FOLLOWING A CHRONIC SUPPURATIVE OSTEOMYELITIS OF THE OS ILEI

THE patient, Mr. O. R., a Bohemian thirty-six years of age, was admitted to the hospital on January 9, 1925, with the following history:

His main complaints were severe pain in the region of the right hip, a numbness of his left arm and leg, and continuous headache.

He had been suffering from occasional "sciatic" pain in both legs for four years. During the two months before admission this pain had localized in the region of the right hip.

On December 15th, about three weeks previous to admission to the hospital, at one o'clock at night he was seized suddenly with an attack of numbness and violent pain in the left arm and leg, following which he had only partial control of his left arm and leg, movements being somewhat restricted. Severe generalized headache was present for three days before admission.

The patient had been under our care off and on for many years. We had performed an operation for varicose veins on him four years ago. Three years ago he had erysipelas of his left leg.

Physical Examination.—The right pupil was slightly smaller than the left, but both reacted to light. There was no pathology in the nose, throat, or chest.

Over the right iliac bone and over the right hip there was a distinct tenderness on palpation, reaching backward to the

sacral bone There was no protrusion, edema, or resistance to be noticed. The left arm showed a loss of sense of position (stereognostic sense), patient with eyes closed could not touch his nose with the forefinger of left hand. The muscle strength of the left arm was markedly impaired Right arm was normal. The left leg was partially paralyzed, *he was not able to raise it.* The sensibility was normal The right leg was normal Knee-jerks were exaggerated on both sides. Ankle clonus was positive on both sides There was no Babinski sign Urine examination was negative. Blood examination showed 11,600 leukocytes. The Wassermann reaction was negative and had been so on several previous occasions Temperature ranged between 100° and 101° F.

The tentative diagnosis was cerebral apoplexy in the right hemisphere. The pain in the right hip could not be satisfactorily explained A roentgenogram of the hip revealed no bone disease. The Lasegue phenomenon was negative, hence the diagnosis of sciatica was doubtful During the next two weeks there was no improvement in the patient's condition, the headache and pain in the right hip gradually becoming worse

On January 31st a swelling developed in the region of the right hip and on February 1st there was marked fluctuation and abscess formation in this region The number of leukocytes went up to 16,000. The patient complained of severe pain in the region of the right hip.

On February 2d under local anesthesia. an incision was made over the site of the abscess and a drain inserted The abscess cavity was about the size of a man's fist, extracapsular, in the region of the great trochanter, and led to the os ilei. The iliac bone showed vast osteomyelitic changes, it was rough and partly destroyed A culture taken from the pus revealed staphylococci.

During the following days there was only a little pus discharged from the abscess cavity. The patient's general condition became markedly worse. A coarse tremor affected both arms and legs and there was a continuous twitching of the facial muscles

On February 6th the temperature began to increase steadily.

and on February 9th he died, developing a temperature of 107° F. shortly before death. During the last few hours there was distinct Cheyne-Stokes respiration.

The clinical findings during the last few days of life suggested a cerebral embolism This diagnosis seemed to explain the symptoms and seemed most probable because staphylococci were found in the pus obtained from the iliac abscess. These germs could in turn have produced an affection of the cardiac valves with subsequent cerebral embolism. The postmortem examination, however, revealed large multiple abscesses of the brain. The pus in the brain was sterile. Smears and cultures on different culture-media revealed no micro-organisms. Inasmuch as the sinuses and the middle ear were not diseased, the abscesses must have been metastatic. Considering the antecedent diseases of erysipelas and ulcer of the leg as etiologic factors in a chronic osteomyelitis of the iliac bone and the brain abscess as a metastatic abscess from that source, it is evident that possibly the early diagnosis of osteomyelitis and its cure by surgical procedure might have prevented the development of the brain abscess An operation on the brain would not have been of any avail as there were multiple abscesses in both hemispheres.

Unusual and misleading for the diagnosis in this case were the facts that the patient did not vomit and did not lose consciousness until shortly before death. Spinal puncture was not possible because of the proximity of the septic focus to the points where the needle would have to be inserted.

In the etiology of abscess of the brain traumatism, direct injury to the brain, and otitis media play a rôle as causative factors. In each case the infection may be directly transmitted from the infected bone to the brain. Transmission of the infection through preformed fissures and canals as the fissures petrosquamosa, canaliculi, tympanocarotid, etc., transportation of an infection from a focus on the outside of the head into the brain through veins, and finally metastatic abscess from an infection anywhere in the body are other sources of brain abscess. Usually the course of an abscess of the brain shows three distinct stages: (1) An initial stage with general cerebral symptoms,

such as headache, vomiting, partial loss of consciousness, etc.; (2) a latent stage which shows no symptoms at all and which may last from a few days to several years, (3) a stage of the manifestations which shows general cerebral symptoms and local symptoms according to the anatomic location of the abscess

The diagnosis may be extremely difficult, in some cases impossible. Sometimes a brain abscess does not produce any symptoms until a few hours before death. Spinal puncture may aid in the differential diagnosis between brain abscess and general or local meningitis. In meningitis the spinal fluid will be cloudy and show a globulin reaction and increased cell count. Brain tumors, however, may exhibit exactly the same symptoms as brain abscesses

The differential diagnosis between diseases of the inner ear and abscess of the brain has been carefully elaborated by Bárány and his special works on that subject may be referred to. In doubtful cases an exploratory puncture of the brain may be done. This, however, is a procedure which has been regarded by many surgeons as being too dangerous because of the possible infection of hitherto uninfected localizations.

The diagnosis having been established the treatment can only be surgical, and an operation (drainage of the abscess) should be done as soon as possible. The method of operation is relatively simple, care being taken to prevent infection of the tissues surrounding the abscess, particularly the meninges. Multiple abscesses such as this patient had offer no hope

SARCOMA OF THE SKULL WITH METASTASES IN THE LUNG AS A RESULT OF AN INJURY

Three years ago the patient, Mr. E , received a blow on the head with a crank. Soon after a lump developed at the site of injury, and gradually increased in size. A few months later he began to have a cough. with occasional slight bloody expectoration. Notwithstanding treatment with electricity, most likely deep x-ray therapy, the tumor on the head grew to an enormous size. Tumors also developed on both sides of the neck. His cough increased and, in addition, a continuous headache became

very troublesome. He lost weight and his appetite became poor.

Physical examination revealed a rather emaciated and anemic man. His head showed a great deformity, which was all the more manifest because he had lost his hair, most likely from the x-ray treatment. There was a distinct tumor mass over the right frontal and lateral hemisphere of the skull, somewhat irregular on its surface, hard, and semi-elastic. The tumor was about twice the size of a man's fist. It was not painful to touch or percussion. It apparently did not extend into the facial portion of the skeleton. There was no fluctuation on any spot, although some parts seem somewhat softer than others. There was a slight indication of scars on the scalp and underneath the lower jaw, particularly on the lateral portions of the neck. One could feel large pockets of glands in the neck of the same consistency as the tumor of the head. The scars on the neck were evidently the result of exploratory removal of some of the tissues for examination. There was no impairment in sight or hearing, nor any evidence of involvement of the central nervous system except the presence of a continuous headache. A roentgenogram of the skull showed complete destruction of the bony tissues in the region of the tumor, suggesting very strongly malignancy.

The lung findings were clinically, diffuse râles but no consolidation except a distinct enlargement of the mediastinal dulness. Fluoroscopically, there was infiltration of the lung with numerous metastatic tumors. The liver was large, three fingers below the border of the ribs, and was probably the site of metastatic growths.

The clinical diagnosis was sarcoma of the skull with metastases in the lung.

A small portion of the tumor on the neck was excised. It was examined by Dr. Pilot, our pathologist, who gave the following report:

"The tumor is surrounded by fibrous tissue and is made up of masses of round- and often spindle-shaped cells. The connective-tissue stroma is distinctly proliferating. Mitotic figures are

few in number. The appearance is that of a malignancy to be
classified among the fibrosarcomata which are, as a rule, not
very malignant. Pathologic diagnosis· Sarcoma of the skin "

On February 22d the patient complained of difficulty in swal-
lowing. x-Ray examination of the chest revealed a large tumor
mass in the *mediastinum*, probably a metastatic tumor, causing
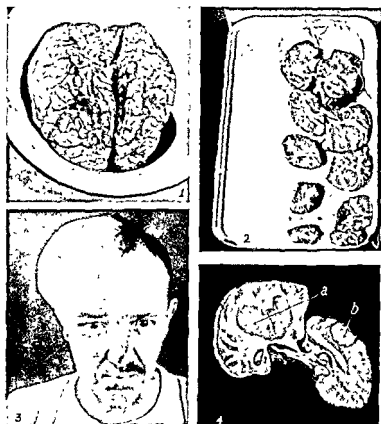
Fig 367—1 Showing the enlargement of hemisphere containing the
abscess 2 Serial sections of brain 3 Showing the sarcoma in the center
of the scar 4 *a, b,* Abscesses

some pressure of the esophagus. It was decided to institute
deep x-ray therapy of the head, chest, and neck in the hope of
reducing the size of the tumors. After three treatments the

patient said he did not feel improved. In fact, some glands of the neck seemed to increase in size.

The prognosis of this case is very unfavorable. He is going to die as a result of the increased pressure on his brain, which is sure to occur notwithstanding all treatment. A tumor so widely disseminated cannot be removed by operation. The only reason for employing x-ray therapy is to reduce the size of the tumors and to prolong the life of the patient.

This is a rare case of a malignant growth in an unusual locality, starting immediately after an injury. An investigation made by insurance companies as to the frequency of malignant growths following injuries has revealed the remarkable fact that only a very few authentic cases could be established. Even in this case, although every indication points to the injury as the cause of the growth of the tumor, one could only apply the old Latin saying, which is not without controversy, *post hoc ergo propter hoc* (it followed, therefore it was caused by it). Of all the cases encountered in our experience in which trauma seemed to be the etiologic factor in malignancy, this is one of the most conclusive.

CLINIC OF DR. J. RAWSON PENNINGTON

COLUMBUS HOSPITAL

"OPEN" OPERATION FOR ANORECTAL FISTULA. TECH-NIC. ADVANTAGES OF THE EXCISION METHOD FOR ANAL AND ANORECTAL FISTULÆ

FRANK M., aged twenty-two, entered hospital on February 9, 1925, because of perianal pain and a discharging sinus in the region of the anus. He states that in September, two years previously, he fell and struck right side of anus against some projection on the floor. Some three weeks later an abscess formed at point struck, and was opened by a surgeon. This never healed completely, but continued to discharge pus from time to time.

I first saw this patient on November 19, 1924, at which time he had a slightly red and very painful swelling at the right of anus. His physician was advised to open it at once, which he did on the following day. December 9th, when I saw him again, he had a discharging sinus, probably a fistula, which followed opening of the abscess.

Operation and Comments.—Here on the right side of the anus and situated well to the front, you will observe is the open-ing of a discharging tract. One can readily palpate this tract as it extends toward the anus. Anointing the field with K. Y. lubricating jelly reduces the friction, and facilitates palpation. This agent is valuable not only in palpating a fistulous tract, but in other conditions which require delicate touch. In view of the history this is either a sinus or a fistula. If this is the external opening of an artificial channel leading to the abscess cavity *only*, it is a sinus; if the channel communicates with the bowel, it is a fistula. Injecting it with water may differentiate. Pass-ing a probe first may close the tract to this injection should the

tract contain small concretions and they become packed in the tract. The water in this instance enters the bowel, which proves it to be a fistula.

I am having quite a little trouble in finding the internal opening with my probe-pointed grooved director, but this is absolutely essential for a successful fistulectomy. The tip of instrument is readily felt with the finger just beneath the mucous membrane, but should I push it through the membrane, making a false passage, then dividing the tract, including the tissues over it, as recommended by some writers, my operation would in all probability be a complete failure.

As you will notice, the probe readily passes forward to the perineal body, also that it can be carried posteriorly to near the coccyx, and that during this complete excursion the point of probe can be felt all along the line just underneath the mucous membrane This is due to the fact that the fistula is Y-shaped, one branch of the Y running just beneath the mucous membrane to near the perineal body, and the other extending just beneath the mucous membrane back to the region of the anococcygeal line. Where the director cannot be made to follow the tract into the bowel, my hooked director may be made to enter the internal opening, and passed along until it meets the director passed in from the external opening. Should this also fail, injecting the tract with methylene-blue (or other coloring material) may facilitate following the tract to its internal opening when operating

Fortunately, I have now located the internal opening, and the probe readily enters the rectum. With the index-finger I now intercept the point of the probe and direct it out through the anal aperture (Fig 368). This internal opening is in the pectinate line

A fistula with the internal opening in the pectinate line should be classified as "anorectal" fistula because when the internal opening is so located it involves both the rectum and the anus If the opening is in the anus then it should be termed an "anal" fistula, or fistula in ano. Where the opening is in the rectum proper, then it should be classified as a "rectal" fistula In other words, fistulæ should be classified according to the ana-

tomic position of the internal opening. I believe this to be a logical classification of proctologic fistulæ; and our treatment, all things being equal, is based upon such logical arrangement.

To operate successfully on a fistula, the entire tract including all contributory tracts must be laid open, and the so-called "pyogenic membrane" must, in some way, be destroyed or re-
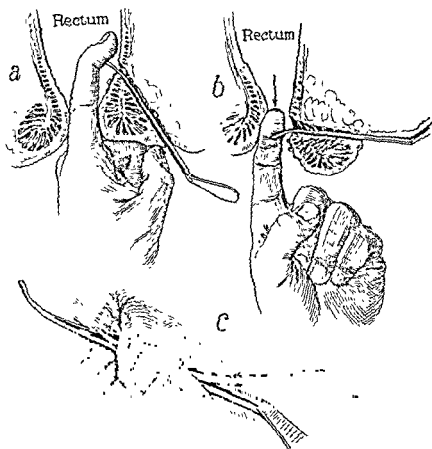
Fig. 368.—*a*, Author's grooved director passed through fistulous tract, engaging index-finger; *b*, pulling grooved director out through anus; *c*, incising tissues over grooved director.

moved. In order to remove or lay this tract open so the pyogenic membrane can be destroyed, it is necessary first to thread the fistula on a probe or grooved director, which will act as a guide during the operation. You see that we now have the main tract of this fistula so threaded on the grooved director, and I shall either incise the tissue over it, then make the "back-cut"

of Salmon through the pyogenic membrane, and let the wound
heal by granulation (open operation), or should I decide to
close the wound (excision with immediate suture) after the
incision, then I will dissect out this membrane (Fig. 369).
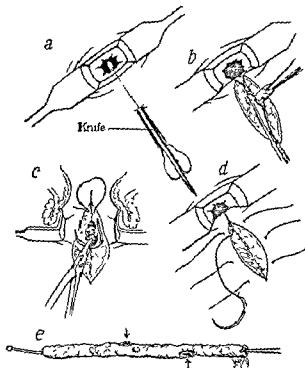
Fig 369 —Author's excision with immediate suture operation for fistula:
a, Grooved director introduced through fistulous tract, and knife passed in
groove, *b*, dissecting out the so-called "pyogenic membrane," after the tissues
between the fistulous tract and the bowel have been divided, *c*, muscles have
been brought together by deep sutures and method of closing mucosa by
suture is shown (note that the needle does not pass through the mucous
membrane), *d*, two deep catgut sutures in place   Silkworm-gut sutures in-
troduced ready for tying, *e*, fistulous tract dissected out and threaded on
probe   Openings seen of two tributary tracts

Furthermore, if I decide to close the wound with immediate
suture before making this incision, then I may dissect out the
tract, leaving it threaded on the director. On this occasion I
shall divide the bridge of tissue, then decide what to do next.

Dividing this bridge of tissue converts the bowel and fistulous tract into one large general tract or channel. Now this addition to the regular channel or cavity, made by dividing the tissues between the rectum and the fistulous tract is, of course, freshly incised tissue and not lined with a pyogenic or mucous membrane. Consequently, it will grow together again, reducing this
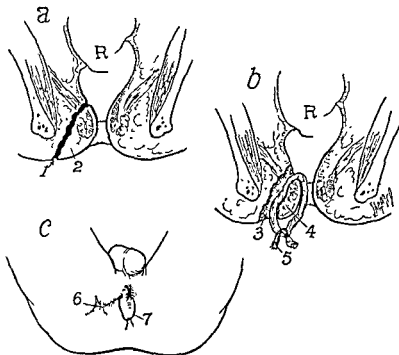
Fig. 370—a, Author's "seton method" for fistula; field before operation: 1, Complete fistula; 2, tissues between fistula and anal canal; b, same; 3, scope of incision toward skin side of fistula; 4, tissues remaining undivided; 5, the seton passed around them and tied; c, same, full view; 6, union of tracts external to sphincter; 7, seton passed through opening into anal canal, and out through anus.

large cavity just made to approximately the same size that the normal cavity was before the division. Moreover, if the divided tunics are reunited in their normal relation, by granulation or by suture the rectum will functionate practically the same as before. The advantages of suturing are: Minimum amount of scar tissue, better approximation, better functioning, better cosmetic effect, and less likelihood of malignancy following.

A similar result invariably follows the open operation for anal fistula, when due to the ordinary causes In anorectal fistula, however, this plan which is known as the "incision method," may not give such happy results, so for this reason I
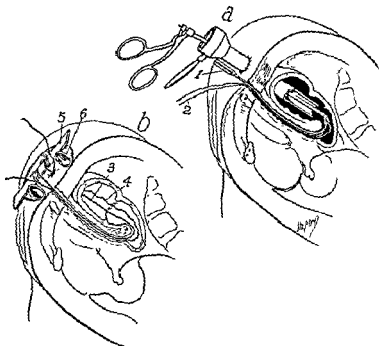
Fig 371 —a, By use of probe (1) with eye in distal end the thread is carried through fistulous tract This thread (2) is grasped by forceps and pulled out through rectum When divided there are two ligatures (3 and 4 in b)—one for an emergency, the other for immediate use—passing through fistula and out of anus, enclosing intervening tissues, b, to make tension on the ligature, the free ends pass through the hole in an inflated pessary, resting on anal region, and wrapped around a flat stick (5), which rests on the elastic pessary (6).

have for many years made it a rule when operating on anorectal fistulæ, other things being equal, to dissect out the pyogenic tract, and close the wound with immediate suture (Fig 369). Though in this particular instance, because of the multiplicity of tracts, and the uncertainty of finding them all, I shall not so

operate, but leave the wound open to heal by granulation the same as in the common anal fistula.

The bridge of tissue over the main tract and the lateral sinuses now divided and the skin edges trimmed, the wound will be dressed with a piece of yellow gauze, other gauze dressings, and a T-bandage. In two days, all the loose outer dressings will be removed and other dressings saturated with Dakin solution applied. The dressings are kept soaked in this solution until they all come away without injury to the wound. The wound if still kept dressed with Dakin dressings, or other means, until healed. The dressings must be applied loosely, not packed into the wound, and latter carefully watched to be sure it heals from the bottom.

In rectal fistula my "seton method" seems to be the operation of choice; the same procedure may be applied to advantage in anorectal fistulæ also (Fig. 370). In the uncommon rectosigmoidal type I use my ligature method with satisfactory results (Fig. 371).

Discussion.—The treatment of anal and anorectal fistula in general may be divided into prophylactic and curative:

Prophylactic.—To use a hibernicism, the time to cure a fistula is before it starts. By this I mean the fistula can, generally speaking, be aborted by early opening of the causal abscess. In this connection it is imperative that the incision be as close as possible to the margin of the anus. Once this is done and the contents set free, the wall of the abscess cavity is not to be irritated by curettage or other instrumentation, but the focus allowed to drain and irrigated every few hours with Dakin's solution, or it can be gently filled with bismuth paste every few days.

Curative.—Here we find several plans available. On several occasions injections in my hands have given excellent results. After a preliminary and thorough cleansing of the tract with neutral solution of chlorinated soda, it is filled with bismuth paste. Since writing this I have had a remarkable instance of the good results occasionally to be had by injection: A man of thirty-five had a fistula of three years' standing which had

been operated on twice unsuccessfully.   Complete healing followed a *single injection* of bismuth paste by me.

My "ligature method" is a modification of the old-time constriction or ligature, which consisted of passing a heavy cord through the outer aperture, then along the track, and out of the inner aperture through the anus, the ends being tied together, the loop is tightened daily until the intervening bridge of tissue is cut through. Besides being painful, it is very slow, often taking some weeks. The only advantage apparent is the avoidance of hemorrhage.

The incision method is still used almost universally. First passing a grooved director through and merely incising the track of the fistula and the tissues distal to it, then allowing the wound to heal by granulation (Fig. 368). My lamented friend, the late J. P. Tuttle, in his well-known text-book, writes that out of 2,196 cases he collected, less than 45 per cent. are even claimed to have been cured. It is probable that nearly all of these were operated on by the method of incision, which, of course, does not discover and remove the tributary tracts and sinuses, so these keep up infection of the field. Another feature to which I have often called attention is that the amount of scar tissue resulting from this plan is decidedly increased. Of late it is well known that malignant changes often originate in cicatricial tissue, either operative or pathologic, and that if smooth healing is secured, such as is possible with my "suture method," the incidence of carcinoma would be materially lessened.

Excision is my method of choice in anal and excision with immediate suture in anorectal fistulæ. The technic is shown in the figures, and no further comment seems necessary. While the operation is often tedious on account of the tortuosity of the track, the end-results abundantly reward one for the extra time consumed.

CLINIC OF DRS. F. B. MOOREHEAD AND K. W. DEWEY

PRESBYTERIAN HOSPITAL

TUBERCULOSIS OF THE MOUTH

It is an astonishing fact that the mouth, a general thorough-
fare for the tubercle bacillus, is only rarely involved in a tuber-
culous lesion. A high percentage of people, especially children
of the poorer population, become infected with tubercle bacilli
through the mouth and nose by contact with tuberculous people;
many patients carry the organism constantly in the mouth; in
pulmonary tuberculosis the sputum may convey enormous
amounts of them into the oral cavity. In spite of all this, tu-
berculous lesions in this locality are but rarely observed. Of
8000 patients examined in a European laryngologic clinic
only 4 cases of tuberculosis of the mouth were found.

It is logical to assume, therefore, that provisions are made and
conditions exist in the mouth which protect the mucous mem-
brane against the localization and pathogenic action of the tu-
bercle bacillus. Such protection is afforded primarily by the
mucous membrane itself, i. e., by the epithelial covering; healthy
epithelium is, in general, an almost impenetrable wall against
micro-organisms. The squamous epithelium of the mouth is
particularly strong and resisting, and small abrasions close
quickly because of the elasticity of this covering. The ciliated
epithelium of the respiratory tract is much more vulnerable, and
in grave pulmonary tuberculosis the larynx and the trachea are
secondarily involved in a relatively high percentage of cases.
Also the presence of a layer of strong, dense connective tissue
beneath the epithelial covering is considered as a protection
against the invasion and localization of tubercle bacilli. The
high vascularity of the mucous membrane increases its power

of resistance. The antibacterial activity of the regional glands and phagocytosis are likewise an aid in the self-defense of the body. The saliva has a prohibitive action, not however through any antiseptic powers, the view that normal human saliva neutralizes bacterial and other toxins, is antiquated. The action simply consists in washing away the bacteria. Thus Koch strongly emphasized the importance of saliva in hindering the growth of tubercle bacilli, which may enter the oral cavity, these, like the morsels of food, are quickly enveloped in saliva, and thus are kept off from direct contact with the mucous membrane before being swallowed. Nor is saliva a good culture-medium for bacteria, and in so far as it also contains saprophytes, which are always present in the oral cavity, the inhibitive action is enhanced, for saprophytes outgrow the pathogenic organisms. Hugenschmidt[1] suggests that the saliva has chemotactic properties in attracting the bactericidal leukocytes; but only saliva containing bacteria is strongly positive in this capacity.

A very important factor in the self-defense of the body is auto-immunization. All people may become infected with tubercle bacilli, regardless of their constitution, but not all become clinically tuberculous. The local conditions have to be especially favorable to invite a pathologic localization of the organisms and they are markedly so in children. Westenhoeffer[2] claims that, "in every child, however healthy it may be, the eruption of the teeth is associated with more or less painful, sometimes also painless, swelling of the lymph-glands of the lower jaw, and although this swelling may not occur at every single eruption it does at any rate occur once in the course of the single periods of eruption, which is an evidence that during dentition infectious substances gain entrance into the glands; of course, they are not always tubercle bacilli." Continuing, he states, "If we take the sum of our experience gained from experiments and statistics, and apply it to the development of tuberculosis the inference is arrived at that all facts tend to show that tuberculosis in childhood develops in the following way: tubercle bacilli gain access into the mucous membrane of the mouth through the lesions produced in dentition; they enter

the lymph-vessels of the neck and continuously or discontinu-
ously produce tuberculosis of the cervical, tracheobronchial,
retrosternal, and eventually also the mesenteric lymph-glands.
It is, of course, possible that tuberculosis of an isolated bronchial
gland originates from the lungs, and tuberculosis of the mesen-
teric glands from the intestines; in fact, I believe the latter is al-
most exclusively caused by an infection of the intestine." Moeller[3]
points out that, "with the great susceptibility of the mucous

Fig 372 —Field at very low magnification showing the peculiar mosaic-
like appearance of the tissue in which areas of epithelial proliferation alter-
nate with areas of marked round-cell infiltration The tubercles are generally
seen in the epithelial areas   × 36.

membrane in the child, even in the absence of injuries an ac-
cumulation of tubercle bacilli in the oral cavity represents a
great danger," while adults are more protected against this
danger by a thicker squamous epithelium. The conditions for
a tuberculous invasion are certainly most favorable during the
later stages of dentition when in the continuous growth of the
tooth the gingival pockets and the alveoli remain open some

of resistance. The antibacterial activity of the regional glands and phagocytosis are likewise an aid in the self-defense of the body. The saliva has a prohibitive action, not however through any antiseptic powers, the view that normal human saliva neutralizes bacterial and other toxins, is antiquated. The action simply consists in washing away the bacteria. Thus Koch strongly emphasized the importance of saliva in hindering the growth of tubercle bacilli, which may enter the oral cavity, these, like the morsels of food, are quickly enveloped in saliva, and thus are kept off from direct contact with the mucous membrane before being swallowed. Nor is saliva a good culture-medium for bacteria, and in so far as it also contains saprophytes, which are always present in the oral cavity, the inhibitive action is enchanced, for saprophytes outgrow the pathogenic organisms Hugenschmidt[1] suggests that the saliva has chemotactic properties in attracting the bactericidal leukocytes, but only saliva containing bacteria is strongly positive in this capacity.

A very important factor in the self-defense of the body is auto-immunization. All people may become infected with tubercle bacilli, regardless of their constitution, but not all become clinically tuberculous The local conditions have to be especially favorable to invite a pathologic localization of the organisms and they are markedly so in children. Westenhoeffer[2] claims that, "in every child, however healthy it may be, the eruption of the teeth is associated with more or less painful, sometimes also painless, swelling of the lymph-glands of the lower jaw, and although this swelling may not occur at every single eruption it does at any rate occur once in the course of the single periods of eruption, which is an evidence that during dentition infectious substances gain entrance into the glands; of course, they are not always tubercle bacilli." Continuing, he states, "If we take the sum of our experience gained from experiments and statistics, and apply it to the development of tuberculosis the inference is arrived at that all facts tend to show that tuberculosis in childhood develops in the following way: tubercle bacilli gain access into the mucous membrane of the mouth through the lesions produced in dentition; they enter

cayed teeth and the frequency of glandular swelling associated with such teeth, and there are numerous reports of cases in which the direct relation of tuberculous enlargement of lymph-glands to caries of the teeth could be demonstrated by the filling of the tubercle bacilli in the diseased teeth and the pathologically changed periodontal tissue. Euler,[9] for example, described a case in which he could show that the development of a tuberculous periodontitis and a tuberculous granuloma was subsequent to

Fig. 373 —Smaller field at higher magnification: (a) Mucous membrane; (b) areas of epithelial proliferation; (c) marked small round-cell infiltration; (d) tubercle containing giant-cells and in process of necrosis. Isolated giant-cells are lying in infiltrated connective-tissue areas. (× 80)

a diseased molar tooth with a necrotic pulp, that there was a tuberculous involvement of portions of the jaw-bone surrounding the tooth and tuberculous degeneration of the regional lymph-glands, while tuberculous lesions in other parts of the body were lacking. Tubercle bacilli were found in the granuloma. In the case of a thirteen-year-old boy Moeller could follow the route of the invasion from an ulcerated tooth even to the apex of the

lung; genuine tubercle bacilli were demonstrated in the infected pulp chamber. Klebs[10] believes that the peculiarly persistent and malignant character of tuberculous lesions in the oral cavity, which he had observed, is due to constant reinfections from diseased teeth It is, however, more generally believed that caries alone are not a cause of any active tuberculous infection, and that pulpitis associated with periodontitis or periostitis are the *conditio sine qua non* It may be mentioned here that Partsch[11] considers the granuloma which so frequently develops at the apex of an infected root canal, as a protecting wall against a further spreading of the micro-organisms. Another view expressed by him that protection is also afforded by the lack of lymph-channels in the dental pulp which make this tissue unfavorable for the transmission of the tubercle bacilli entering the pulp cavity through the dentine, must be regarded as untenable Lymph-vessels in the pulp have been demonstrated by Schweitzer[12] in 1907, a fact acknowledged by such anatomists as Testut [13] Since then also Dewey and Noyes[14] have succeeded in demonstrating them.

Highly virulent tubercle bacilli, tested by animal experiments, have been found in carious teeth, yet the surrounding tissues were entirely free from any tuberculous processes They have been repeatedly found in the newborn, who *did not show* any demonstrable disease In some individuals they are apparently without any pathogenic action, in others with other local and general conditions their presence may be the cause of an active tuberculosis Disposition undoubtedly plays an important part A discussion of this question cannot be entered upon in this paper Gruber[15] states "Today we know that earliest childhood evidently is exceedingly susceptible to infection with tubercle bacilli, much more so than later ages Today we know that the infection may be carried about in a latent stage for years and decades, until weakening of the body by malnutrition, overwork, pregnancy and nursing, sexual excesses, alcoholic and other poisoning, certain infectious diseases, as measles and influenza, arouse the latent organisms and cause an outbreak of the tuberculous disease."

The most important protection perhaps ensues from the fact, recently observed, that the acid-fast tubercle bacilli do not find any favorable conditions for life in the detritus of the pulp and are there transformed into Much's granules.[16] These are said to die after having remained in the pulp for some time or to remain latent and relatively harmless so long as there are any forces or conditions which prevent the formation of acid-fast substances without which the granular form cannot multiply. What the character of these substances is we do not know. Zilz believes the results of investigations indicate that lactic acid, which is being formed in the decomposition of albuminous substances and to which also the tissue of the dental pulp belongs, plays a rôle; it may have some importance either with regard to the lessening of the virulence observed in the granules inhabiting the pulp chambers or with reference to the demonstration of acid-fast tubercle bacilli in this locality, which generally fails. Zilz could show by animal experiments that necrotic pulp tissue of carious teeth was fully virulent and undoubtedly tuberculous, although acid-fast tubercle bacilli could not be demonstrated in this tissue. There were, indeed, exclusively Much's granules in the ulcerated root canals, while beyond the apex acid-fast tubercle bacilli could be demonstrated in the proliferated periosteum which showed characteristic tuberculous lesions. Zilz states that these acid-fast tubercles may have developed from the granular form in the very process of passing through the apex. In places which are cut off from nutrition, and a putrid pulp is undoubtedly such tissue, the tubercle bacilli lose their acid-fast substance and their body breaks up into granules, "each of which represents again an individual life center." These granules retain their resistance by taking up new substances (neutral fat); they are not acid fast, but virulent, and occur in three types, as solid rods, single granules, or rows of granules, and only stain with Gram's stain. They are incorporated in various sizes and numbers into the body of the acid-fast tubercle bacilli or lie opposed to them, and represent a virulent form of development, in fact, the most resistant of all forms known so far, which, when transformed to a suitable culture medium, develops into

the acid-fast form The invasion of tubercle bacilli may therefore be supposed to occur in the following way: Much's granules lodged in putrid root canals pass either by way of the apical foramen or possibly also through the dentine into the periodontal membrane, where they find a favorable soil and develop into the acid-fast tubercle. If this is really the process, we can easily understand why the demonstration of a tuberculous infection through carious teeth has generally failed, for the customary staining methods for tubercle bacilli do not demonstrate the granules. We also may assume then that a tuberculous infection through carious teeth is more frequent than was hitherto believed, especially in children.

Active mixed infections play an important rôle in the development of primary tuberculosis from carious teeth. Zilz found that Much's granules had been in a gangrenous pulp for months, *perhaps for years, without producing any symptoms, when* in the course of influenza a periodontitis developed which prepared the soil in which the inactive granular form could develop into highly virulent acid-fast tubercle bacilli In other cases there had been streptococcus and staphylococcus infections as preparatory agents. Experiments have shown that tubercle bacilli and other micro-organisms (Fränkel's diplococci, streptococcus, Staphylococcus, tetragenus) mutually increase their virulence and that certain types of micro-organisms which are otherwise non-pathogenic may be made *pathogenic for certain animals by symbiosis* The toxins of the tubercle bacillus promote the growth of streptococci, staphylococci, and bacillus coli. The latter grow the better the richer the medium is made in tubercle toxins. It was also observed that the virulence of colon bacilli was greater when grown on tuberculin bouillon agar than of coli grown on pure agar.

Apparently there is always a local inflammation or an acute infectious disease which precedes the development of tuberculosis and it is not the tubercle bacillus which primarily causes inflammatory processes.

As to the source, Zilz divides the cases of tuberculosis of the mouth into three groups: (1) Infections occurring directly from

the mouth (exogenous origin); (2) infections by hematogenous embolic transmission (endogenous origin); (3) mixed infections in which other micro-organisms incite the tubercle bacilli harboring in a locus minoris resistentiæ to pathogenic and cause an eruption of them, so to speak (eruptive form).

The most frequent mode of infection is *per continuitatem* from the lips and the skin of the face and by transmission from the primarily infected lungs and the larynx. If a tuberculous
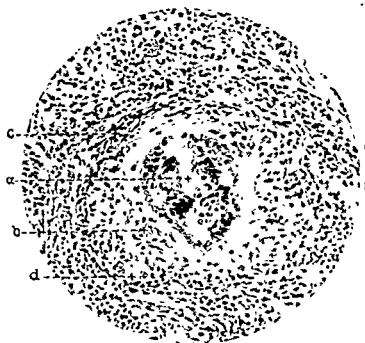
Fig. 374.—(a) Huge giant-cell with an unusually large number of nuclei which are not arranged as in the typical Langhans giant-cells, (b) epithelioid cells in immediate neighborhood of the giant-cell; (c) small round-cells peripherally to them, (d) small giant-cell

focus in the lung break into the bronchi, dissemination of tubercle bacilli over the surfaces of the mucous membrane takes place. From the bronchi the bacilli spread into the trachea, larynx, and the oral cavity. The edges and the tip of the tongue being the most easily injured, are the most frequently involved; less often are tuberculous lesions in the mucous membrane of the palate, the gum tissue, the lips, and other regions of the

mouth. The protective measures prove to be insufficient in cachectic tuberculous people, in them tuberculous ulcerations of the tongue, in the palate, and at the corner of the mouth are not so very rare There are likewise ineffective in lupus of the mucous membrane, which, as Ehrhardt[17] states, "starts from lumpus of the skin at the mouth by progressing beneath the epithelium along the lymph-channels, thereby entirely fore-going the influence of the saliva as one of the protective agents "

The primary form of tuberculosis of the oral cavity is exceedingly rare Carious teeth may be the cause, directly or indirectly. The extraction of teeth has been observed in some cases as followed by primary tuberculosis of the mucous membrane Erhardt reported a case of a girl nine years old, healthy, and without any hereditary tendency to tuberculosis in whom after the extraction of a premolar tooth there was thickening of the alveolar process, at the same time the regional glands enlarged and lumpus of the mucous membrane developed. Exceptionally, it has been observed to occur from drinking fresh milk from tuberculous cows (Weber[15]) and from contact of the mucous membrane of the mouth with infected material Misch[19] *believes that a primary infection by inhalation of tubercle bacilli* cannot be considered as utterly impossible.

The endogenous form of tuberculosis of the mouth is actually an auto-infection The cases are extremely rare and occur as an acute miliary tuberculosis in the skin as well as the mucous membrane of the mouth The importance of an infection of tubercle bacilli by way of the blood-vessels has received more attention in later years According to more recent investigation the presence of tubercle bacilli in the blood is more frequent than was hitherto believed, and does not only occur in miliary but also in chronic tuberculosis Zilz refers to Rosenberger and Kurashige who found tubercle bacilli in 100 per cent. of cases of chronic tuberculosis. The latter found even tubercle bacilli in the blood of as much as 50 per cent. of apparently healthy physicians and nurses Kurashige believes that a primary bacillemia or at least a generalized tuberculosis is the rule and only secondarily can tubercle bacilli settle in a locus minoris resistentiæ.

As to the course which tuberculosis of the mouth may take the possibilities are as follows: the process may remain local and soon heal, or it may propagate locally *per continuatem*, or it may spread and form metastases by way of the lymph and blood-vessels.

The local propagation may extend to very remote organs and produce a disseminated tuberculosis. Neisser reported a case

Fig 375.—Caseation of tubercle in center of the field. There is marked round-cell infiltration in all parts of the tissue not occupied by proliferated epithelium. (× 70)

in which tuberculosis of the epididymis developed in the course of tuberculosis of the mucous membrane of the mouth.

The case reported here is that of a man forty-two years old, who presented himself on October 6, 1919 to F. B. Moorehead's Clinic, with the following condition of the mouth: A granular appearance and ulceration of the tissues in the oral cavity on the superior maxillary ridge, on the buccal surface on both sides, extending from the region of the first and second upper molars

toward the hard palate, but involving the hard palahe only on the right side The condition began about three years ago The patient believed that the trouble originated fifteen years ago by reason of a bump on the jaw from a dog's head subsequent to which a chronic abscess developed. Half a year ago the teeth in this region were extracted The area involved had a granular appearance and was pink and clean. There was not much pain in the parts affected. A small piece was cut from the right side for microscopic examination which revealed the presence of tubercles and tubercle bacilli Lactic acid was applied until November 13th In spite of the treatment, the condition of his mouth became worse and it was decided that he had a tuberculous involvement of the alveolar process and the soft parts of the throat He grew weak and the pain became severe He was admitted to the Cook County Hospital with the complaint of pain and ulceration of the mouth and throat, dysphagia, cough and expectoration, weakness, loss of weight, and fever The attending physician, Dr John Ritter, treated him with large quantities of iodin in milk The patient stated that he had been chronically ill, with periods of apparent good health, for about twenty years He had not been bed-fast, but had usually been able to work most of the time. He was worse in winter, but even then he suffered very little He had been at Oak Forest in May, 1919, where he remained four months, gaining 15 pounds during that time At the time of his admission to the hospital the pain in his mouth and throat was very severe, he could not masticate food, nor swallow, and had been using a stomach-tube for two weeks The left side of his mouth was worse at that time, swollen and tender The cough was not severe in type, but had been present several years intermittently There were no gastro-intestinal troubles, bowels were regular, appetite was good, there were no urinary troubles The vision was good, the left ear was entirely deaf, following a mastoid operation twenty-two years previous. Venereal disease was denied The patient had married three years ago, there were no children His mother died of tuberculosis at the age of forty

Physical examination revealed a temperature of 101° F., pulse,

120, of good quality; respiration, 22; blood-pressure—systolic 110, diastolic 70.

In the mouth there were several areas of ulceration about the gums, soft palate, and mucous membrane of the cheek. The ulcers were shallow, irregular, having a pale, pinkish floor. The teeth were carious and the gums in a very bad condition. No good view of the pharynx could be had because of extreme pain. Necrotic ulcerations were found on the floor of the left nasal cavity; foul crusts and necrotic material were washed out with the spray. Examination of the nose showed that the left in-
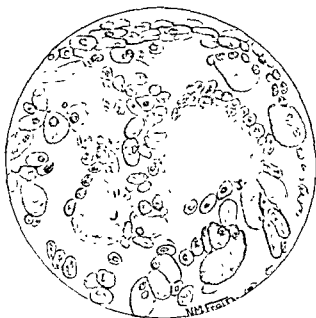
Fig 376 —Giant-cells containing tubercle bacilli.

ferior turbinate was destroyed by ulcerative processes involving its lines of attachment, and the contiguous areas were crust-covered. The left cheek was swollen and tender. There were limited motion of the mandible, tenderness about the angles of the jaws, bilateral adenopathy.

The examination of the lungs led to the following diagnosis: Bilateral fibro-ulcerative pulmonary tuberculosis involving the entire upper lobes, with cavitation, almost entire, of the right lobe; probably cavities in the left lobe.

The patient died February 2, 1920.

This case is clearly one of primary pulmonary tuberculosis with secondary tuberculous involvement of the mucous membrane of the mouth. The trauma may, as the patient claimed, have started the diseased condition of the mouth by awakening a focus harboring latent tubercle bacilli and lowering the resistance of the tissue in this region. The process may have been relatively slow and remained localized for several years. The extraction of teeth in the diseased region at a time when the condition evidently had become considerably aggravated possibly aided in the spreading of the process to the maxillary sinus and the nose. The disease progressed rapidly with ulceration of the mucous membranes.

Microscopic examination of the tissue on October 6, 1919, showed the following. Marked proliferation of the squamous epithelium of the mucous membrane, the tissue has in fact an epitheliomatous appearance; the rest of the tissue is practically all granulation tissue, all through are scattered numerous small tubercles, showing the characteristic elements—small round-cells, epithelial cells and giant-cells. Many of them have central necrosis. There is marked lymphocytic and leukocytic infiltration. Leukocytes are found especially in the epithelium. In some regions the infiltrating cells are chiefly plasma-cells. The tubercles are preferable in the connective-tissue islands within the proliferated epithelium, often there is no trace of the connective-tissue core left and the tubercles seem to be embedded in the epithelial cell proliferations themselves; the squamous cells are frequently so changed that they resemble fibroblasts. In these tubercles surrounded by an epithelial border the degenerative processes are generally quite marked. Liquefaction and absorption of the necrotic tissue has separated the central tissue and this has shrunk away from the peripheral zone. In such tubercles the small round-cells are frequently entirely lacking, generally, some leukocytes have invaded the epithelium. Acid-fast tubercle bacilli were found in most of the sections. They are not numerous, the field chosen for illustration is exceptional in the number of bacilli present.

A small piece of tissue was injected subcutaneously into two guinea-pigs which rapidly developed tuberculosis.

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KINKS OF THE NECK OF THE GALL-BLADDER AND THE BEGINNING OF THE CYSTIC DUCT

In the course of my gall-bladder surgery I have been impressed with the not infrequent finding of kinks at the neck of the gall-bladder and beginning of the cystic duct which interfere with emptying the gall-bladder and give rise to attacks of typical gall-bladder colic.

During the year 1920 I had under my care a girl eighteen years of age, who presented the typical picture of gall-bladder disease. For some time she had attacks of colicky pain in the region of the gall-bladder, associated with radiation of the pain to the right scapula, together with severe pain on deep inspiration and marked tenderness over the gall-bladder area, accompanied by slight fever and a slight increase in the leukocyte count. She had consulted an internist who told her mother that if the mother presented the same findings he would feel without any question that she had gall-bladder disease, but due to the youth of the patient he did not feel so certain of his diagnosis. Consequently, the patient was brought to me. From the history and findings I felt quite certain that she was suffering from gall-bladder disease and advised her mother to get the opinion of a second internist, since I felt that operation was indicated. This second internist agreed that an exploratory operation was warranted. He was present when I operated on the patient. When the gall-bladder was exposed it looked normal. The liver, however, was slightly enlarged and its lower margin was definitely rounded and the lymph-gland at the junction of the cystic and common ducts was enlarged, as is so often seen in gall-

bladder disease. In view of the definite history and colicky attacks that she had been suffering from, I decided to do a cholecystectomy, as there was no other demonstrable pathology in the abdomen. When I informed the internist of my intention, he shrugged his shoulders as much as to insinuate that he was not very enthusiastic about the need for such treatment in the absence of any more definite objective findings. A cholecystectomy was easily performed. On examining the specimen I noted a definite backward kinking of the neck of the gall-bladder and the beginning of the cystic duct, which seemed to me was sufficiently marked to interfere with the ready emptying of the gall-bladder. The kinking was so acute that I felt it offered a very definite obstruction to emptying of the gall-bladder, and that this had probably been responsible for her attacks of colicky pain, so typical of pathology in the gall-bladder. In view of the internist's skeptical attitude toward my operation, I was greatly gratified, on visiting the patient the following morning, to have her volunteer the information that now she could breathe deeply without any pain. She made an uneventful recovery and has never had any recurrence of gall-bladder symptoms.

That was my first experience with gall-bladder colic due to kinking of the neck of the gall-bladder and I had never seen any reference to it in the literature.

About six months later I had a second similar case. The patient, a woman, thirty-five years old, the mother of two children, presented a definite history typical of gall-bladder disease, which she dated back five years, following the birth of her youngest child. Two or three months after the confinement she began having pains in the gall-bladder region, radiating to the right scapula and deep in the chest. This pain came on in attacks, and at the time I saw her had been occurring every few days or every few weeks. There had been jaundice with some of the attacks. The pains had been severe enough to keep her awake at night. There was no history of nausea, vomiting, or fever. Examination showed no abnormal findings except definite tenderness over the gall-bladder area. Temperature was normal, as was the leukocyte count. Operation was advised and per-
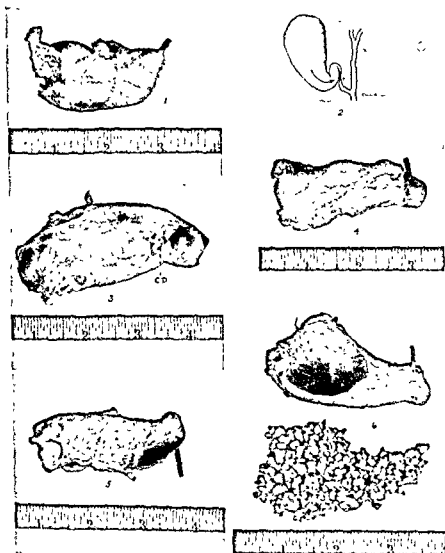
Fig 377.—1 Photograph from Case II This was taken with a piece of toothpick in the beginning of the cystic duct The sharp curve in the neck of the gall-bladder does not show in this photograph, but the deposit of lipoids beneath the mucosa, giving the coarse mucous folds a streaky look, is clearly seen. 2. Diagram to show how the bent portion of the cystic duct at the point marked + causes a valvular closure of the cystic duct when sudden pressure is made upon the contents of the gall-bladder in a direction as shown by the arrow. (After Schmieden.) 3 In this photograph the neck of the gall-bladder and the beginning of the cystic duct ran a spiral course: C D., Site of division of the cystic duct. 4 Free surface of the gall-bladder in a case showing a sharp kink of the neck and the beginning of the cystic duct 5. Liver surface of the same case as shown in No 4

formed. The gall-bladder when exposed looked essentially normal, but in view of the definite history I decided to remove it, as I believed it was responsible for her symptoms. The specimen when examined showed essentially the same picture as was described in the first case Here also there was a very definite kink at the neck of the gall bladder near the origin of the cystic duct The wall of the gall-bladder was, if anything, slightly thinner than normal and seemed fibrous. The folds of the mucosa were higher than normal and glistened, due to lipoids deposited beneath the mucosa, giving it a definite yellow, streaky look (Fig 377) The patient made an uneventful recovery and has been entirely free from all pain since the operation.

Pathologic Report --Diagnosis.—Subacute catarrhal cholecystitis.

Gross.—Opened gall-bladder, 7 by 3.5 cm. Wall thin and smooth Mucosa finely granular and slightly congested.

Microscopic.—The villi are long and slender. Their stroma is edematous At the tips of a few of the villi the stroma is cellular and covering epithelium is absent The wall shows little changes except congestion and slight edema of the stroma between the muscle bundles.

In the next few months I had two other similar cases and decided to report my observations, when an article appeared by Schmieden and Rohde[1] on gall-bladder stasis, which they presented before the German Surgical Society in April, 1921. They made similar observations and came to the same conclusions as I. Since that time I have encountered quite a number of similar cases in my practice. In 1923 Seelig reported a similar case and concurred in Schmieden's conclusions [2]

While most anatomies show the gall-bladder as a pear-shaped organ and the cystic duct running in a direct course from the neck of the gall-bladder obliquely downward to the common duct, joining it at an acute angle, some few anatomies show a definite backward curve of the terminal portion of the neck of

[1] Schmieden and Rohde, Archiv für klinische Chirurgie, vol 118, pp 14-53

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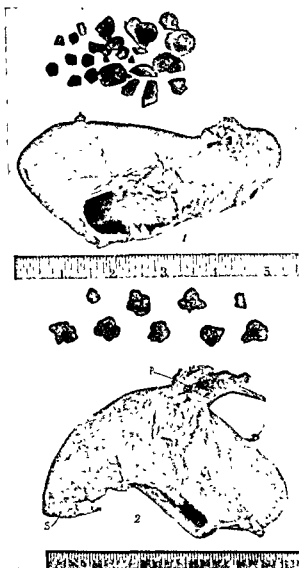
Fig. 378—1. Hydrops of the gall-bladder with empyema and stones
Note that the large stone, which has been broken to study it, shows a typical
radiate cholesterol center, the type typical of delayed emptying with resultant
inspissation, even with sterile bile   The outer layers are stratified calcium,
as so frequently results from infection   Note how far the beginning of the
cystic duct lies from the anatomically proximal end of the gall-bladder.
A piece of toothpick has been placed in the beginning of the cystic duct
2 Photograph of gall-bladder removed from a case of rupture of the gall-
bladder, with resulting subphrenic abscess   Note site of rupture (P) along the
free surface; the gall-bladder contained, in addition to the nine black bile-
pigment stones shown alongside the gall-bladder, one large stone (S) occluding
the neck of the gall-bladder.   This can be seen through the gall-bladder wall
at the site of the sharp kink in the neck of the gall-bladder and the beginning
of the cystic duct.

the gall-bladder and of the first portion of the cystic duct. This is probably most extreme in the illustration in Poirier and Charpy's Anatomy. In Hartmann's[1] recent monograph on Surgery of the Biliary Passages, there is an interesting study on the curves of the neck of the gall-bladder and of the first portion of the cystic duct, contributed by Maurice Virenque. In all cases of curvature of the neck of the gall-bladder and of the cystic duct the variations are merely in the neck and in the first portion of the cystic duct, the terminal end of the cystic duct is always straight, that is, presents no curvatures. The four planes in which a curvature of the neck of the gall-bladder and beginning of the cystic duct can occur are laterally toward the median line, that is, to the left, laterally to the right, that is, away from the median line, in a superior direction or in an inferior direction. In a series of cadavers he studied the anatomy of the gall-bladder neck and the cystic duct in 60 infants and 50 adults. The variations found are shown in Fig 380. In the 60 infants he found in 23 the proximal portion of the neck of the gall-bladder curved slightly obliquely upward and to the left (Type 1). This he considers the normal curvature. In 21 cases there was no curvature either of the neck or of the cystic duct (Type 2). In 11 cases there was a curvature to the right and then a second curvature to the left (Type 3). In 2 cases the neck was directed sharply upward and backward toward the fundus for a short distance and then turned sharply downward and medially, this forming an S-shaped curve in a superior direction (Type 4). In 1 case the neck was curved downward sharply, then backward toward the fundus, and further on sharply to the left and downward to the common duct, thus an S-shaped curve in an inferior direction (Type 5). In 1 case there was a simple U-shaped curve of the adjacent portions of the neck and beginning of the cystic duct in a posterior direction (Type 6).

In the 50 adult cases. 34 showed a curve laterally to the left (Type 1). In 4 cases there was an absence of any curvature (Type 2). In 8 cases the curvature was to the right (Type 3).

[1] Hartmann, Chirurgie des voies Bihaires, Masson et Cie, Paris, 1923, pp. 31–36.

In 1 case the curvature was in a superior direction and toward the fundus and then downward toward the common duct (Type 4). In 2 cases there was a U-shaped curvature with the concavity upward, in 1 case there was a U-shaped curvature with the concavity downward (Type 6).

From these observations it is clear that curvatures of the neck of the gall-bladder and of the cystic duct cannot be looked upon as abnormalities, but simply variations in type which frequently occur. However, when these curves are unusually marked it is easy to understand that they may well offer an obstruction to the emptying of the gall-bladder, and it is well known that any factor which delays the emptying of the bile from the gall-bladder must be looked upon as a potential cause of inspissation of the bile, resulting in gall-stone formation. As pointed out by Aschoff and Bachmeister, inspissation of bile is responsible for the formation of aseptic radiate cholesterin stones. On the other hand, concentrically stratified, pigmented calcium stones owe their origin, according to Naunyn, to inflammatory changes in the gall-bladder, to the so-called stone-forming catarrhal inflammation.

In my first 2 cases the sharp backward curvature of the cystic duct was not demonstrable until after the gall-bladder had been removed. I found this in other cases since, and for this reason I have of late, in a rather large proportion of cases, gone back to the older technic of beginning my gall-bladder removal from the fundus toward the cystic duct in order to clearly identify the cystic duct in its course before applying clamps and dividing it.

The *pathologic changes* in the gall-bladders with sharply kinked necks and cystic ducts and the associated clinical symptoms that I have observed agree exactly with those described by Schmieden, and I independently arrived at the same conclusions as regards the mechanism producing the symptoms, that is when such a gall-bladder attempts to empty itself by contraction of its musculature and meets with a definite obstruction pain is caused just as occurs in intestinal obstruction, and that so long as the muscle is in a state of contraction the pain

tinues In cases in which the condition has existed for only a
relatively short time the mucosa presents coarse folds which are
more widely separated than normal, while the other layers are
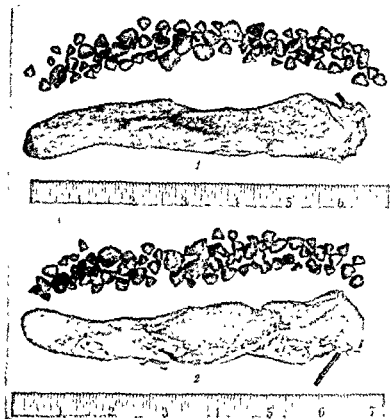
Fig 179 —1 The unusual length of this gall-bladder in relation to the
unusually narrow width is striking Schmieden has called attention to the
fact that when stasis of the gall-bladder occurs, there is a tendency for the
gall-bladder to elongate 2 Same specimen as shown in No 1 Note the
hypertrophy of the muscle bundles This has been assumed to be due to
overwork, in an attempt to overcome the obstruction at the neck of the
gall-bladder and beginning of the cystic duct

usually thicker than normal due to congestion and edema.
Microscopically the folds of mucosa are seen to be hyperemic
and edematous, with slight lymphocytic infiltration. Aschoff

has pointed out that this coarse appearance of the folds is due to the presence of large, pale, round cells in the subepithelial connective tissue, which are in part endothelial cells from the lymph-vessels and contain a lipoid substance due to absorption of fat from the bile finding its way through the mucosa epithelium into the lymph-vessels, and in the case of stasis with this increased pressure condition is continually absorbed to an abnormal degree (Fig. 379). Otherwise, the epithelium is intact. Schmieden points out that the first significant changes due to intravesical pressure is dilatation of Luschka's ducts. Luschka's ducts normally never reach as deep as the muscularis, but in these cases they are deepened, penetrating well down into the muscularis and in some cases even to the serosa. These changes in Luschka's ducts are the first result of the increased intravesical tension; the normally delicate branching spaces become wide tubes, often with rounded ends, resembling a tobacco pouch. The muscularis is definitely hypertrophied, the individual muscle bundles are thicker and the individual fibers are larger and their number increased, and there is a characteristic congestion and edema of all the layers of the gall-bladder with interstitial lymphocytic infiltration in all the layers. Later these changes in the musculature resemble the changes in the bladder muscle in prostatic hypertrophy and for the same reason—a work hypertrophy in an effort for a hollow viscus to empty its contents against an obstruction—and just as occurs in the bladder in prostatatic hypertrophy overdistention results, the muscle later becoming thin and atrophic. The end stage shows a thinning of all the layers with fibrosis. The fibrous layer is usually slightly thickened and in late stages there is often a hypertrophy of the connective tissue. The subserosa and serosa usually show no changes except congestion of the blood-vessels. This typical passive hyperemia, congestion hyperemia, is present in all layers at all stages, and it is responsible for the transudation of serum which produces the edema that is so characteristic. This edema is particularly marked in the fibrous layers, subserosa, and mucosa. In the uncomplicated cases the bile is sterile.

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From the fact that Schmieden had 14 such cases in a single year in which he operated under the diagnosis of gall-stone disease, and all these cases showed the above-described pathologic-anatomic picture, and that all the cases were completely cured by cholecystectomy, he states that the condition of stasis in the gall-bladder must not only be looked upon as a pathologic-anatomic expression, but that it presents a well-characterized clinical entity. My experience is entirely in accord with his

Clinically these patients present short colicky attacks of pain in the region of the gall-bladder, often referred to the shoulder-blades. In addition, they complain of indefinite distress in the gall-bladder area and gastro-intestinal discomfort. While Schmieden never found icterus in any of his cases, some of my cases had progressed and had become associated with definite cholecystitis, and in some cases associated with the formation of gall-stones (Figs 377, 6, 378, 379). In 1 case the condition had gone on to empyema of the gall-bladder and rupture, with the formation of a subphrenic abscess (Fig. 378, 2). In the simple cases without cholecystitis or gall-stones these short attacks of biliary colic are followed by a period in which the patient feels entirely well and in which the gall-bladder is not tender on pressure. During the time the colic is present the gall-bladder is tender on pressure, and this may be slight or marked. In uncomplicated cases, that is, in which cholecystitis *and* stones are absent, neither jaundice nor fever are present. Schmieden believes that the obstruction is not only due to kinks in the gall-bladder neck and cystic duct, but from a study of his specimens he has found evidence that leads him to believe that mucous folds in the gall-bladder neck at the origin of the cystic duct and Heister's valves in the cystic duct are associated etiologic factors in the obstruction (Fig 380). I have preserved most of my specimens intact, but in one case I found a mucous fold at the beginning of cystic duct which had a trap-door arrangement and almost certainly contributed to the obstruction. Schmieden's specimens are rather convincing

It is clear that the only rational method of *treatment is to remove the gall-bladder*. This Schmieden did in all his cases, with
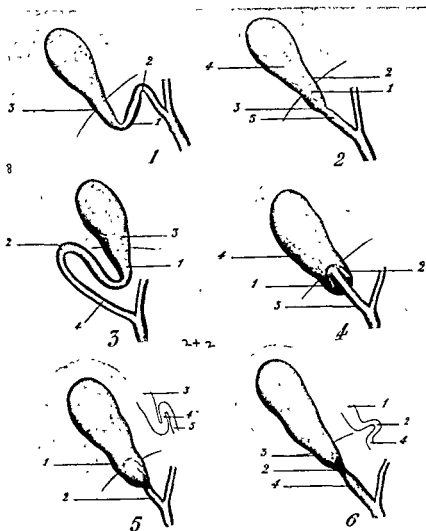
Fig 380.—Types of curvature of the neck of the gall-bladder and the beginning of the cystic duct found in a study of cadavers (after Virenque):

	No in 50 adults	No in 60 infants	Total.
Type I	34	23	57
Type II	4	21	25
Type III	8	11	19
Type IV	1	2	3
Type V	0	1	1
Type VI	4	1	5

cure in every instance, and my experience has been identical with his.

In closing, the essential point I wish to make is that when one encounters a patient with a definite history and findings suggesting gall-bladder disease, and at operation exposes what appears to be a normal gall-bladder, there is no logical reason to drain such a gall-bladder, and there is every reason to perform cholecystectomy, for not only is it impossible to determine whether or not inflammatory conditions are present in the walls of such a gall-bladder which are not visible from a study of its outer surface, but my experience convinces me that one may have before him a case presenting an abnormally sharp kink at the gall-bladder neck and the beginning of the cystic duct which is often not obvious until after such a gall-bladder has been removed

URETHRAL STRICTURE

WE speak of strictures as being congenital or acquired, as
being permeable or impermeable, as being single or multiple, as
being resilient or non-resilient, as being annular, linear or bridle-
like, as being complicated or not, spasmodic, inflammatory, etc.
I will confess that when this list was first quoted by one of my
instructors, the task of understanding them seemed insuperable.
It was not until the underlying pathology was explained that all
of this apparently confusing array of terms began to have a mean-
ing, hence let us first discuss the changes which take place when a
stricture is formed and its sequelæ develop.

We will devote most of our time, so far as the congenital and
acquired forms are concerned, to the latter, because the congen-
ital is most commonly due (a) to the hypertrophy of the veru-
montanum, as Bugbee has shown, or (b) to folds which act as
obstructions. Either one of these will result in such marked
dilatation of the bladder, ureter, and renal pelvis in infancy that
the underlying cause is often overlooked. That a spasm of the
compressor urethræ muscle can simulate a true acquired stricture
cannot be denied, but one can easily exclude such a form of ob-
struction by patience in introducing a urethral instrument.
Aside from this transitory stenosis, nearly every stricture met
with in adults is the result of an inflammatory process. Eighty
per cent. approximately are the result of gonorrheal infection and
appear months to years after apparent cure. The remaining
20 per cent. includes those due to trauma with secondary reac-
tive inflammatory changes or to tuberculosis usually secondary
to a primary invasion of the kidneys, prostate, or epididymi.

A stricture due to gonorrhea may occur anywhere in the urethra, the majority however are found close to the junction of the bulbous and membranous portions of the urethra, the minority in the pendulous portions   A gonorrheal stricture of the prostatic urethra is a rarity   The opposite is true of the tuberculous form, viz , they are almost invariably found in the prostatic urethra.   A traumatic stricture is rare in the pendulous and bulbous portions, but most common in the membranous, which is the most fixed portion and most likely to sustain the brunt of a blow or a fall on the perineum or be torn by a fracture of the pubic bones.

During the later stages of gonorrhea there is a tendency toward infiltration of the submucous tissues by inflammatory cells (Fig 381, A)   These become converted into fibrous tissue and the overlying mucous membrane is either completely or partially destroyed   With the contraction of this newly formed connective tissue the lumen of the urethra is compressed (Fig. 381, B) or distorted in a variable manner   After this very brief outline of the pathologic changes let us return to some of the terms which I mentioned at the beginning of the clinic.

The meaning of the terms "single" and "multiple" is self-evident, in other words, one may find a stricture admitting an instrument of one caliber in the anterior (pendulous) and one admitting a much smaller or larger instrument in the posterior (bulbomembranous) portion   We must be constantly on our guard lest we overlook the existence of two or more strictured areas

The terms "permeable" and "impermeable" are equally self-evident, but let me warn you never to call a stricture impermeable until every possible method, to be described shortly, has been employed   For example, if one forgets that the opening through which urine is passed is not in the center, i e , concentric (Fig 381, B), but away from the center, i e , excentric (Fig 381, C), we are apt to be content to call the stricture impermeable when a single filiform has been inserted (Fig. 381, D), whereas, if a number are simultaneously inserted (Fig. 381, E), one of them will pass through the opening because the other filiform bougies have
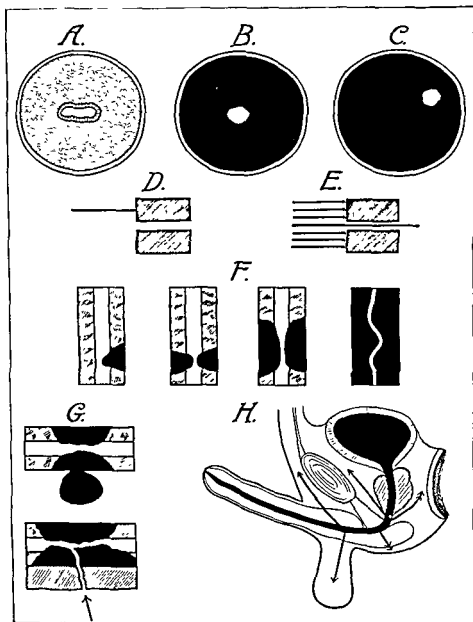
Fig 381.—*A*, Infiltration of mucosa, submucosa, and periurethral tissues with inflammatory cells in gonorrhea, *B*, organization into fibrous tissue with formation of a stricture with concentric opening; *C*, stricture with excentric opening, *D*, single filiform meeting obstruction at face of stricture; *E*, one of many filiforms passes through stricture, *F*, types of strictures (from left to right) incomplete (only partly surrounding lumen), linear (limited area of constriction), annular (wider area of constriction), and spiral (or corkscrew), *G*, periurethral abscess (upper) and fistula (lower); *H*, spread of infection in direction of arrows from various portions of deep urethra. (See text)

filled up the lumen of the urethra at the face or distal side of the stricture to such an extent that the last filiform takes the path of least resistance through the opening (excentric) of the stricture (Fig. 381, E).

The fibrous tissue at the point of stricture may completely surround the urethral lumen (Fig. 381, B), and we refer to it as an annular or linear stricture, according to the length of the involvement (Fig. 381, F). If the strictured area only involves a portion of the circumference, it is often spoken of as "the bridle" variety, i. e., a band or bar running transversely (Fig. 381, F) to the long axis of the urethra I have examined cases in which one passed across a series of such elevations. The last of the terms still employed in connection with strictures are resilient and non-resilient, or cartilaginous and non-cartilaginous, or non-dilatable and dilatable. By these we mean the impression obtained during the passage of solid bougies or metal sounds through the narrowed area. If the fibrous tissue in the latter permits a dilating instrument to pass through but immediately "springs back" to its original lumen, we speak of it as being resilient, and these strictures are the most discouraging to treat because no matter how often we divide them operatively or dilate them by non-operative methods, they seem to be just as rigid and to obstruct the lumen as much as before anything was done, when we examine them later.

From what has just been said, you will agree that unless you are able to visualize the local changes in the urethra as well as those in the remainder of the genito-urinary tract and in the body in general, the subject of urethral stricture will always appear to be an impenetrable maze.

It will be impossible to describe all of the local complications of urethral stricture so that they will only be enumerated. They are: (a) Periurethral abscess and fistula (Fig. 381, G); (b) phlegmonous infiltration of the scrotum, abdominal wall, and along the pelvic connective-tissue planes (Fig. 381, H); (c) acute or chronic retention of urine; (d) hypertrophy and later atony of the bladder wall; (e) formation of false shallow diverticula, or (f) the growth through back pressure of previously existing (con-

genital) diverticula, (g) dilatation of the ureter, (h) two varieties of kidney parenchyma changes, viz., hydronephrotic atrophy from back pressure with dilatation of the renal pelvis or ascending infection (pyelonephritis), (i) periureteral or perinephritic suppuration, (j) infections of the prostate, seminal vesicles, and epididymi.

The systemic complications are those incident (a) to the retention of waste products in the blood and tissues which should be eliminated by the kidneys, and (b) to toxemia as the result of the infection in the urinary tract. The term "urosepsis" is often used to express the clinical condition resulting from the urinary tract infection.

Diagnosis.—The first patient to be presented today complains of a gleety discharge and difficulty in urination. Let us see how much information can be obtained by examination (a) of the body in general, and (b) of the urinary tract. The former reveals nothing abnormal in the cardiovascular, respiratory, nervous, and alimentary systems. The examination for evidences of disease of the central nervous system is especially important, because many a case of bladder atony due to tabes may simulate the retention due to a stricture, it being conceded however that the two may coexist. The blood chemistry of this first patient indicates that there is retention due to inability of the kidneys to function properly.

We begin our local examination by first palpating the testis and epididimis on each side for evidence of a complicating infection and next ascertain whether there is also an absence of a similar condition in the prostate and seminal vesicles, by rectal palpation, etc. We also note that the patient's urine is quite turbid and has a strong ammoniacal odor indicating infection with urea-decomposing organisms.

Let us now proceed with the local examination: We first insert a bulbous bougie (preferably not a metal one), beginning with a No. 20 (French) size, and find that we meet with an obstruction at the bulbomembranous junction. Using smaller and smaller bulbous bougies, we find that only a filiform (whalebone) bougie will pass through the strictured area. Let me digress for

a short time to direct attention to some of the instruments with which you must be familiar before undertaking either the diagnosis or treatment (non-operative) of a case of urethral stricture.

Soft-rubber Catheters—These can only be sterilized by boiling There are three varieties to be considered in stricture cases· (a) The ordinary, with a solid tip and an opening close to it, (b) the olivary (Fig 382, A), with a long slender neck which can
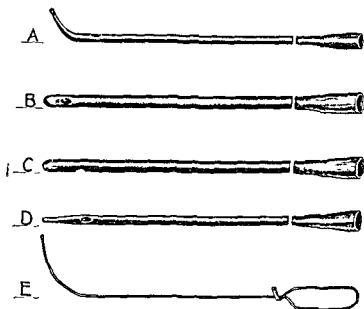
Fig 382 —A, Olivary type of soft-rubber catheter, B, Wishard soft-rubber catheter with hollow tip so that it can be easily threaded on metal mandrin (E of this illustration), C, soft-rubber catheter with open end for use as retention catheters, D, olivary wax-silk catheter

easily find its way through a strictured area, (c) the Wishard catheter (Fig 382, B), with a hollow tip, so that it can be threaded upon a special mandrin and passed through a stricture, finally, (d) a soft-rubber catheter (Fig 382, C), with an open end for use as a retention catheter I will now show you the various soft-rubber catheters

Silk or Hard Catheters—These have an olivary tip and a

narrow neck (Fig. 382, D) in which there is an opening and can
only be sterilized by formalin or by immersing in a 1 : 5000
biniodid of mercury solution for ten to fifteen minutes.

Silver Catheters.—It is desirable to have a variety of sizes of
the ordinary metal catheter and also of the "follow-up" variety.
The latter are indispensable if one has occasion to see many
cases of stricture. The flexible filiform bougie (Fig. 383) is first
passed through the strictured area in cases of acute retention,
then the catheter portion is attached and follows the filiform
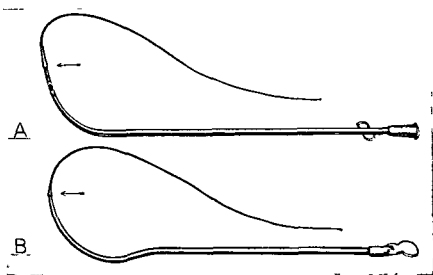
Fig 383 —A, "Follow-up" metal catheter (see text), B, "Follow-up"
metal sound (see text). The arrows point to threaded portion where the fili-
form guide is attached (after passing through the stricture) to the catheter
or sound, respectively

guide until the bladder is reached and the urine gradually evacu-
ated. These are the various types of catheters which we employ
to evacuate urine. We must not omit to mention some instru-
ments which can be used for the same purpose but are most often
employed in treatment. I refer to the various types of whale-
bone filiforms and flexible catheters (silk). We ought to have
at our disposal eight to ten of each variety. The straight, the
bayonet and the spiral or corkscrew filiforms (Fig. 384) can often
be passed through a stricture when everything else has failed.
In difficult cases, a number of filiform straight bougies are

carried to the face of the stricture and then another one inserted (Fig. 381 *E*) which will often be able to pass through an opening near the periphery of the face of the stricture when a single filiform has failed The same is true of the bayonet or corkscrew (Fig. 384) filiforms These will often pass through a stricture with an excentric opening (Fig 381, *C*) or through a stricture in which the canal is not a straight one but pursues a tortuous or spiral course (Fig 381, *F*) when the ordinary straight filiform fails to pass through.

Bulbous Bougies.—These can be of metal alone or constructed like the "hard" catheters, *i. e.*, of wax and shellac on a
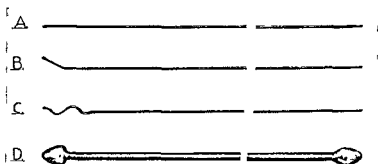
Fig 384 —A, Filiform bougie (straight), B, bayonet filiform, C, Corkscrew filiform, and D, bulbous bougie (flexible and made of silk covered with wax and shellac) Note that it has an olivary tip at one end and an acorn-shaped tip at the other

silk matrix (Fig 384, *D*). *We prefer the latter because they are more flexible than the metal variety* One should have a variety of sizes from No 24 French down to 3 French.

Instruments Used for Dilating Strictures.—*Metal*—There are three types of sounds: (*a*) Those with the Van Buren (Fig. 385, C), (*b*) those with the Benique (Fig 385, D) curve, and (*c*) follow-up sounds (Fig. 383, B). The latter are constructed like the follow-up catheters (Fig. 383, A) and can be used by first passing the flexible filiform bougie through the stricture, attaching the sound, and permitting it to follow the bougie into the

bladder. These follow-up, or Le Fort, sounds are of especial value in narrow strictures between 10 and 20 French caliber.

Bougies (Wax, Silk, or Hard) —For strictures which do not admit a No. 20 French the use of hard bougies, as we shall see later, is warmly recommended. The olivary tip and narrow neck enables these non-boilable bougies to be more readily passed through a narrow stricture than any other form of dilating instrument. They represent an intermediate step between the filiform bougie and metal sounds. We like to employ them until
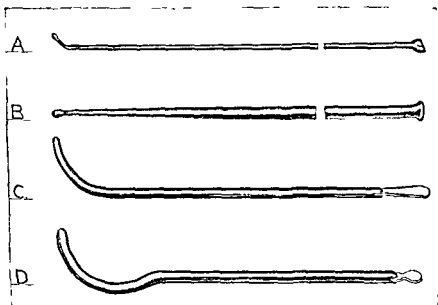
Fig 385 —A, Bayonet bougie (larger sizes than filiform) for dilating stricture with eccentric opening, B, straight olivary-tipped bougie for dilatation of stricture up to No. 18 to 20 French, or even higher, C, metal sound with Van Buren-Keyes curve, D, metal sound with Benique curve.

a No. 18 to 20 French can be passed through a stricture and then to continue with sounds.

We now find upon examination of this patient that he has a stricture in the pendulous urethra about 5 cm. behind the external meatus which admits a No. 16 French bulbous bougie, and another stricture about 13 cm. back which barely admits a filiform bougie. By employing a follow-up catheter we are able to pass through the strictured area in the posterior urethra. The urine obtained by this procedure is very turbid and has a

marked ammoniacal odor We have examined this same patient about a week ago with a small No. 16 cystoscope and found that there was marked trabeculization over the entire bladder mucosa and many shallow (false) diverticula which we call cellules to distinguish them from the larger ones, which many believe to be congenital and not the result of obstruction in the urethra or at the bladder neck We have examined this patient's blood and find that there is evidence of retention of urea and creatinin, and through the aid of the phthalein test have found that the renal function is below normal There is also one local complication in the form of an indurated area over the perineum which on palpation can be followed as deep as the bulbous portion of the urethra At the cutaneous end of this almost cartilaginous mass is a minute opening from which turbid urine escapes at intervals We are dealing with a complication of the stricture in the form of a fistula communicating internally with the urethra and externally with the perineum (Fig 381, *G*) Summing up, the patient has multiple strictures, infection of his bladder and probably kidney, with urea-decomposing organisms, hypertrophy of the bladder wall, due to the effort of expelling the urine against the obstacle in the urethra and last, but not least, evidences of back pressure on the upper urinary tract and of waste-product retention in the blood I have mentioned these in the order in which we found them during our examination of the patient the past week and wish to impress upon you the necessity of a similar thorough urologic study of every patient suffering from urethral stricture, provided that his clinical condition offers no contraindications By using a small cystoscope we can obtain much information as to the condition of the bladder and as to whether the stricture is complicated by calculi or some form of bladder neck obstruction In a recent case I thought that the patient, when first seen during an attack of acute retention, ought to void urine spontaneously after the stricture had been dilated until it admitted a No. 27 French sound easily Further study, however, revealed the fact that we were dealing with an enlarged (adenomatous) prostate which completely blocked the vesical outlet and required removal,

after which the retention disappeared completely. The case first presented illustrates the principles of diagnosis, so let me now present some of those underlying our methods of treatment in uncomplicated cases as well as in those which present more or less serious complications.

Complications of Urethral Stricture.—I have just attempted to impress the necessity of a thorough local, as well as a complete general study of every case. If we neglect either of these, disaster will surely follow in the shape of a high mortality rate and dissatisfaction on the part both of the patient and the physician with the end-result. Now what are the possible local and general complications. Let us first consider the local ones.

(a) ACUTE OR CHRONIC RETENTION.—It is not difficult to visualize how the lumen of the strictured area may decrease to such an extent as to cause this complication. The acute form of retention often follows exposure to cold, or alcoholic or sexual excesses. We find one of three clinical pictures, viz., the patient is able to pass a few drops at intervals, or he is unable to pass any urine, or, finally, there is an overflow (incontinence of retention), so that constant dribbling is present. In all of these the discomfort is very marked, the distended bladder either gives rise to dulness on percussion extending a variable distance above the pubis as far up as the umbilicus, or unless there is rigidity of the abdominal wall one can feel the distended viscus with its upper border often as high as the umbilicus. The chronic form of retention seldom gives rise, as does the acute, to subjective symptoms of much severity. It is only through determination of the amount of residual urine and interpretation of the systemic symptoms of toxemia or of waste-product retention that the damage which such a chronic retention has done can be estimated. The poor nutrition, dry tongue and skin, apathy, often complicated by chills, fever and sweats (the last named as expressions of renal infection) are familiar manifestations of the generalized results of acute or chronic retention.

(b) PERIURETHRAL LOCALIZED INFECTION OR FISTULA.—The first named may occur as a circumscribed abscess (Fig. 381, G), with symptoms and findings which it is superfluous to enumer-

ing, or has symptoms incident to chronic retention of urine; or, finally, we are consulted because of one of the many complications which I referred to earlier in today's clinic. Let us take up the question of treatment with these various clinical pictures in mind and first consider:

1. CASES OF ACUTE RETENTION OF URINE WITHOUT COMPLICATIONS.—We find such individuals with a bladder more or less distended, often to the umbilicus They are either unable to pass any urine at all or we find that a few drops can be voided at intervals, but not enough to relieve their distress. My own views as to how to treat this class of cases may differ radically from those you have been taught, but a relatively large experience in city hospitals enables one to formulate a definite plan of treatment which, although leaning toward conservatism, has much to support it. Let me illustrate this view at once in connection with these cases of acute retention. If you are patient and also familiar with the various types of instruments demonstrated earlier today, you will be able to gradually empty the bladder in practically every case unless such complications as diffuse phlegmonous infiltration or a false passage are present. Acute retention usually occurs in the almost impermeable stage of stricture formation, hence begin with a straight filiform bougie (Fig. 384) and by gentle manipulation see if you can pass through the obstructed area. It is inadvisable ever to empty the bladder suddenly because this is followed at times by a sudden fall in blood-pressure with resultant anuria or severe renal bleeding, hence it suffices to permit urine to escape along side of such a filiform catheter fastened into the urethra like we do with an inlying catheter. Even if three or four days are required to empty such a distended bladder, you will have better immediate and end-results than if you resorted to early perineal section. If one filiform will not pass, insert five or six more along side the first one. At times the opening will be excentric and the filiform which you have inserted last will pass through because the others have distended the lumen (Fig. 381) so much that the tip of this last inserted one is forced through the excentric opening. In the case of a more concentric channel through the stric-

ture the same mechanism occurs only where the last bougie to be inserted slips through the opening because the others leave only this route open. When you fail in the attempt to employ straight, bayonet, and corkscrew filiforms, all shown today (Fig. 384), try to pass a softer flexible filiform which can be attached to a follow-up metal catheter (Fig. 383), or use a long tapering silk catheter made in one piece for such a purpose. At times you will be surprised to see how easily a soft (Fig. 382, A) or hard (silk-wax) olivary tipped (Fig. 382, D) catheter will pass through. If none of these are successful, one must consider some operative procedure, always under sacral block and regional, never if avoidable, under general anesthesia. Much depends on the condition of the patient as to which type of operation to perform.

There are two possible avenues of operative approach to the distended bladder, one by the perineal route, i. e., external urethrotomy and the other by suprapubic cystotomy. If the patient shows evidences of a generalized sepsis and especially if someone who is not equipped with the proper urethral catheters, etc., has attempted in vain to pass through the stricture and perhaps has greatly traumatized the urethra or even caused a false passage, I believe that it is better judgment to open the bladder by the suprapubic route under local anesthesia and to operate on the stricture later, if necessary. Even in cases where the general condition is good and no previous efforts have been made to empty the bladder, I believe conservatism should prevail here because external urethrotomy without a guide is a very difficult procedure when the tissues are acutely inflamed.

2. ACUTE RETENTION WITH COMPLICATIONS.—The chief complication with which you come in contact in these cases is diffuse phlegmonous infiltration with extension (Fig. 381, H) along the cellular planes, as I explained earlier in the clinic of today. The patient is usually suffering from marked toxemia, often the scrotum enormously swollen and bladder greatly distended. Many urologists prefer an external urethrotomy, even without a guide, in addition to ample drainage of the affected cellular planes. I am of the opinion that both the immediate

and end-results would be better if we contented ourselves with a suprapubic cystotomy under local anesthesia and multiple stab-wound incisions through the skin overlying the infiltrated areas with ample provision for drainage of the subcutaneous and deeper tissues by insertion of through-and-through rubber tubes. To try to find the urethra in the midst of all of the edema incident to such a diffuse periurethral infection is not only difficult but jeopardizes the prognosis. After the infection subsides one is often surprised to find that conservative measures in the form of gradual dilatation of the strictured area will be successful.

3. CHRONIC RETENTION WITHOUT COMPLICATIONS.—The more strictures one encounters, the more one becomes impressed with the possibility of treating nearly all of them by conservative methods, viz., dilatation. We find that in large hospitals like this one we are easily able to pass large sized sounds after ure-throtomy during the patient's stay in the hospital. After being discharged, however, he fails to have the after-treatment carried out as it should be. In a year, or even less, the strictured area contracts again and the vicious circle is established. He returns to this hospital in the same condition as though no operation had been performed and is re-operated Hence I believe that the *cases in which either internal or external urethrotomy should be done is decreasing as one learns to persevere in dilatation plus efforts to combat the accompanying infection of the entire urin-ary tract* Urethral, vesical, and even renal (pelvis) irrigation will accomplish wonders when combined with dilatation at regu-lar intervals. We begin with either small olivary bougies or follow-up sounds (Fig. 383) from No. 12 French up to No. 18 or 20 French and then employ larger sized solid bougies until we we are ready to change to the Benique metal sound (Fig 385, D), when the lumen of the urethra at the strictured area or areas admits a No. 20 to 22 French. It is advisable to enlarge the external opening of the urethra in the majority of cases by means of a meatotomy so as to be able to pass sounds up to No. 30 French Never fail to add a urethral and vesical irrigation to the treatment, with some urinary antiseptic, remembering never to employ too much pressure on account of the danger of reflux

into the renal pelves. If the stricture is of the resilient (*i. e.*, recontracts as soon as dilated) or is of the hard almost cartilaginous variety, one is at times forced to perform an internal urethrotomy for strictures in the pendulous urethra and an external urethrotomy for strictures in the bulbous and membranous portions. Since employing transsacral and caudal anesthesia one can perform both forms of urethrotomy without a general anesthetic.

4. CHRONIC RETENTION WITH COMPLICATIONS.—In this I include local complications only. It is self-evident that it is inadvisable to undertake any active treatment of a stricture until a systemic condition such as that, for example, due to a urosepsis is cleared up by appropriate efforts to clean up the infection of the urinary tract. Any operative procedure undertaken while the patient is septic is poor judgment. We should content ourselves with as little local interference as possible until the general condition has been greatly improved and the blood chemistry shows that there is but little nitrogen retention.

The cases with local complications in the shape of single or multiple fistulæ, of plastic induration with or without fistula, of chronic prostatitis or vesiculitis require special consideration. The fistulous tracts must be excised *en masse* at the same sitting as when the strictured area is divided by internal or external urethrotomy, respectively. In the case of a single fistulous tract of long standing or when the entire region is a mass of such tracts our task is of herculean proportions. An infection of the prostate or vesicles should be treated in the usual manner before one begins any course of dilatations for the stricture itself, and especially any operative procedure. A plastic induration of the penis must be excised if it does not disappear after treatment of the stricture with dilatation, etc.

If epididymitis is present, wait until it has subsided before doing much in the shape of local treatment for the stricture. If attacks of epididymitis recur at frequent intervals, it is well to advise the patient to permit a bilateral vasectomy to be performed. Marion, of Paris, was the first to suggest this procedure as a prophylactic step against epididymitis, and I have

followed this suggestion in all prostatectomies for the past year
with very satisfactory results. In these old stricture cases with
badly infected urine one could make far more rapid progress if
the possibility of an epididymitis were not constantly threatening.

Before we close this bird's-eye view of the subject of urethral
stricture let me again direct your attention to the necessity of
bearing in mind that an elderly patient with acute or chronic
retention of urine may have both a urethral stricture and a true
bladder neck obstruction, also that an apparent acute or partial
retention of urine may be the result of an atony of the muscula-
ture of the bladder incident to tabes or to old age. Finally, an
abscess of the prostate, or of the ischiorectal region (the latter of
rectal origin), may compress the urethral lumen and cause acute
urinary retention simulating that of a true stricture. Traumatic
strictures are much more difficult to dilate than the postgonor-
rheal type, but even urethrotomy is of little but temporary
benefit unless dilatation is followed up. The treatment of the
strictures complicating urogenital tuberculosis is that of the
underlying affection unless the stricture becomes impermeable.

CLINIC OF DRS. ALFRED A. STRAUSS, LEON BLOCH, JOSEPH C. FRIEDMAN, AND WALTER W. HAMBURGER

FROM THE STOMACH GROUP AT MICHAEL REESE HOSPITAL

SARCOMA OF THE DUODENUM AND STOMACH

WE wish to present to you this morning 5 cases of sarcoma and lymphosarcoma of the stomach and duodenum, first, because of the extreme rarity of these conditions, and second, because of the interesting clinical history and course which each patient presented.

Sarcoma of the stomach and duodenum occurs in about 1 per cent. of all stomach tumors. It differs from carcinoma of the stomach in that it infiltrates the muscularis and the submucosa and, therefore, many times it is impossible to demonstrate a sarcoma with the fluoroscope or x-ray. This is one of the distinct characteristic differences between the sarcoma and carcinoma from a roentgenographic standpoint. There is usually a history of tarry stools or the vomiting of blood and in that respect sarcoma acts very much like bleeding gastric or duodenal ulcer. The symptoms of pain and abdominal discomfort are much less marked than they are in ulcer or carcinoma. There is one outstanding fact which can be readily gathered from the clinical history and which to our mind is very important from a clinical standpoint, namely, hemorrhage from the small intestine or the constant finding of occult blood in the stools. We want to point out that when one finds occult blood or macroscopic blood in the stools in the absence of any roentgenographic findings in the intestinal tract, that he is dealing with a local lesion in the stomach or small intestine that can be easily found and eradicated. This is not only true in adults, but is also true in

children. We have now 4 cases of bleeding Meckel's diverticulum in children, none of which had been diagnosed, and the patients passed from clinic to clinic with the diagnosis of bleeding enteritis. The x-ray findings were negative, both on fluoroscopic and plate examination. The repeated attacks of hemorrhage led us to make a diagnosis of a lesion in the small intestine. In each case exploratory laparotomy revealed a typical bleeding Meckel's diverticulum, which was removed, and the patients made complete recoveries.

The first patient we have today is a man, sixty-two years of age, who presented himself in April, 1922 with a history of hav-
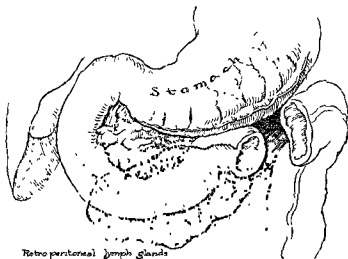
Fig 386

ing had tarry stools, hematuria, and occasional pain in the abdomen which was colicky in character, but never very severe. About two weeks previous to entrance to the hospital he first noticed a tarry bowel movement which was thin and watery. Four such movements occurred within three hours and he vomited several times, the vomitus containing food previously eaten. For the next two or three days he noticed dizziness and weakness. The hematuria appeared a week later. There was no pain before, during, or after urination. The patient had had nephritis for eleven years with a blood-pressure of 200 to 210.

Physical examination was entirely negative, as was the gastro-intestinal x-ray. Hemoglobin was 40 per cent, red cells 3,000,000, and white count 6500. These symptoms completely subsided until March, 1923, when he began to notice severe pain in the lower abdomen which came on at irregular intervals, lasting about one-half hour. The pain was not localized and was relieved by enema and the passage of flatus. An exploratory operation was performed by another surgeon, who found a large mass retroperitoneally in the upper abdomen and a chronically
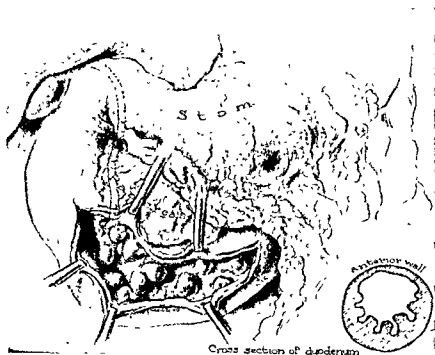
Cross section of duodenum

Fig. 387.

inflamed gall-bladder. Several lymph-glands were palpable along the right iliac vessels. The gall-bladder was removed. The patient made an uneventful recovery.

Six weeks later he re-entered the hospital because of a severe dizzy spell, which caused him to fall to the floor, weakness, and exhaustion. Blood examination showed a hemoglobin of 36 per cent., red cells 3,250,000, and white count 5200. The stools contained a large amount of blood. x-Ray examination showed a normal stomach, but the duodenal bulb did not fill out com-

pletely. The third portion of the duodenum took a rather wide course and showed a peculiar irregularity (Fig. 386). There was a marked deformity with small nodules.

Because of his anemic condition the patient was given three blood transfusions at intervals of one week each. An exploratory operation was then performed. An oblique incision was made through the rectus to expose the stomach and duodenum. On palpation there was felt a large mass extending along the second and third portions of the duodenum which resembled retroperitoneal lymph-glands (Fig. 387). On opening the duodenum the revere multiple nodules varying from the size of a hazelnut to that of a split pea studding the posterior wall. This process extended from the ampulla of Vater to the ligament of Trietz (Fig. 387). These nodules were rather soft and did not have the hard resistance or consistency of carcinoma. One of these nodules was removed for microscopic examination (Fig. 388, 1). Pyloric closure was performed by the fascial transplant method, followed by a gastro-enterostomy. The object of doing this type of operation in such a case is that we are not dealing with a condition like an ulcer where we have to consider the possibility of a gastrojejunal ulcer, but with one in which there is a pathologic duodenum, and when food passes through it hemorrhage will take place. By doing a pyloric closure and gastro-enterostomy we have put the part absolutely at rest and the sarcomatous portion of the duodenum is not irritated by food.

Microscopic examination of the nodules removed showed lymphosarcoma (Fig. 388, 1).

Following the operation the patient received deep *x*-ray therapy over the anterior and posterior abdominal walls. He has made an unusual recovery. It is now two years since the operation, he has gained 40 pounds in weight, his hemoglobin is 90 per cent. and the red count 5,000,000, and he is in excellent health.

The second patient is a girl of twenty who was admitted to the hospital in August, 1923 with a history of marked weakness, loss of appetite, shortness of breath, and marked anemia. She

had previously been treated for some type of secondary anemia. Examination of the stools revealed large quantities of blood. The x-ray showed a minute defect of the duodenum at the site of the duodenal cap. Her hemoglobin was 19 per cent., red count was slightly over 1,000,000, and white count 5000.

The patient was transfused after admission to the hospital, but within a few weeks again lost the blood which was given her,
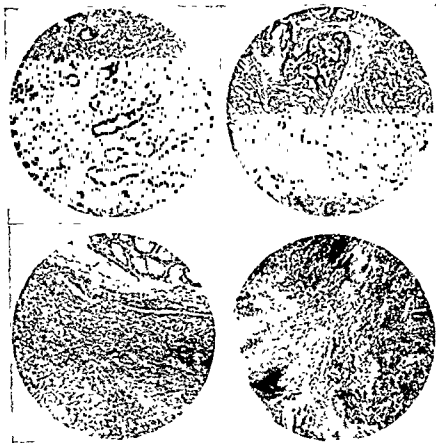
Fig 388.

as evidenced by tarry stools, marked pallor, and low hemoglobin. A diagnosis was made of bleeding duodenal ulcer, but there were certain characteristics about the patient—the slow chronic course of the bleeding which was not typical of duodenal ulcer and the defect in the duodenum which was not typical—that led us to believe that she was not suffering from a duodenal ulcer.

Another fact was that for many years she had had a typical polypoid cavernous hemangioma of the tongue and the possibility of similar lesions in the intestinal tract was considered. However, a tentative *diagnosis of bleeding duodenal ulcer* was made and the patient prepared for operation by another blood transfusion.

At operation a small mass with rather large blood-vessels leading to it was found in the duodenum just beyond the pyloric ring which corresponded exactly with the defect shown in the x-ray plate This mass was excised and on its mucous surface one could see fairly large open blood-vessels The duodenum was closed and a pyloric closure performed by the fascial transplant method, followed by a posterior gastro-enterostomy. Following the operation another transfusion was given The pathologic diagnosis was lymph-endothelioma of the duodenum.

Within a week this patient had tarry stools again, the hemoglobin came down to 20, the red count to something over 1,000,-000, and the white count to 6000. It was evident that some local point of pathology was still present in the small bowel, which we had overlooked Four weeks following the first operation it was decided to do a second exploratory operation, with the hope of following the duodenum down to the ileocecal valve and examining every bit of the small intestine

The patient was again given a blood transfusion. A midline incision was made and the duodenum carefully followed to the ligament of Trietz About midway between the ligament of Trietz and the ileocecal valve there was found a simple intussusception of the small intestine in which there was a tumor mass about as large as the *tip of the index-finger and which was the* causative factor for the intussusception The intussusception was easily reduced and the tumor mass removed. This mass looked exactly like a cavernous hemangioma and was similar in appearance to the one she had on the tongue An end-to-end anastomosis was made. The pathologic diagnosis was polypoid cavernous hemangioma of the ileum (Fig. 388, 2).

It is now a year and a half since the patient was operated

upon. She has gained 25 pounds in weight, her hemoglobin is 90 per cent., and the red count above 4,000,000.

The case illustrates the fact that failing in the first attempt to relieve the hemorrhage, though a lesion was removed from the duodenum it was up to the surgeon to reoperate and find another lesion which produced bleeding.

The third patient is a woman forty-eight years old, who came to the hospital because of mild gastric symptoms, which were not really sufficient in themselves to cause her to consult a doctor, but did so on account of the discovery by her of a mass in the midline of the abdomen   x-Ray examination showed a defect in the lesser curvature and some type of pathology along the greater curvature which had the characteristics of an extragastric tumor.

A midline incision was made and on opening the abdomen a large mass was found which involved the greater curvature and the mesocolon adjacent to it. Passing the hand into the lesser peritoneal cavity it was quite evident that the mass in the mesocolon consisted of enlarged lymph-glands the size of a small orange. Upon careful palpation it was decided that a resection was advisable. A high resection of the typical Polya short-loop postcolic type was made and we were able to dissect the mass of glands from the mesocolon. Microscopically, the mass was a typical lymphosarcoma (Fig. 388, 3).

It is now four months since the operation and the patient is in excellent health.

The fourth patient had a large round-cell sarcoma of the stomach, with some ulceration which involved practically 80 per cent. of the entire stomach. x-Ray examination was entirely negative. The patient was extremely emaciated and very pale, with a hemoglobin of 18 per cent. He was passing large quantities of blood in the form of tarry stools. He complained of some pain, a great deal of nausea, and occasionally of vomiting. The vomitus was very dark in color.

It was decided to give the patient saline and glucose for several days, followed by a blood transfusion as preparation for operation. A typical high Polya resection was performed, leaving

enough stomach for anastomosis. The patient made an un-
eventful recovery. It is now four years since his operation and
he seems to be in excellent health, with no signs of a recurrence
of the lymphosarcoma. It is unusual for this type of sarcoma
to give such a favorable prognosis.

Finally, we wish to show you the specimen of a lymphosarcoma
which involves practically 85 to 90 per cent. of the stomach.
This was removed from a patient thirty-three years of age who
had been diagnosed as a possible ulcer of the stomach, with the
additional possibility of tuberculous enteritis, since a mass could
be felt in the umbilical region of the abdomen.

x-Ray examination was negative. Upon operation there was
found a very large sarcoma which involved practically the entire
stomach. The patient, in addition to having a very low hemo-
globin and being in very poor physical condition, showed a marked
lymphocytosis, 73 per cent. of small lymphocytes. In spite of
the poor condition after saline and glucose and blood transfusion
an attempt was made to resect this tremendous mass. The pa-
tient did well for several days, but finally went into collapse with
definite symptoms of cardiac failure and died within five days
following operation.

CONCLUSIONS —The cases which we have demonstrated to
you this morning show, first, that tarry stools usually mean a
local lesion in the small intestine or stomach; second, that in
lymphosarcoma of the duodenum a pyloric closure and gastro-
enterostomy so as to exclude the sarcomatous portion of the
bowel, followed with deep x-ray therapy, offers a favorable
outlook for the patient, much more so than in carcinoma, third,
that sarcomas of the stomach seem to run at least as good a clinical
course as far as length of life is concerned as do carcinomas.

POSTOPERATIVE HERNIA FOLLOWING CHOLECYSTECTOMY

THE first patient for demonstration this morning is Miss J. W., who entered the hospital December 19, 1924 for medical treatment and observation with a diagnosis of chronic cholecystitis and acute bronchitis. There was a definite history of gall-bladder disease with the characteristic physical findings. Owing to the respiratory tract infection operation was not deemed advisable. After medical treatment for four weeks she was discharged from the hospital on January 17, 1925, with instructions to return for operation as soon as the respiratory infection had subsided.

She returned to the hospital on February 5, 1925 apparently much improved as far as the bronchitis was concerned, but still suffering with the gall-bladder condition. She had lost considerable weight and it did not seem wise to postpone operation any longer.

Owing to the recent respiratory infection operation was performed under ethylene-oxygen anesthesia on February 17, 1925. A chronic cholecystitis with a number of mulberry stones was present. There were some small angiomatous cysts the size of a pea on the under surface of the liver. A cholecystectomy and appendectomy were performed. The cystic duct and artery were ligated separately. The cut surface from which the gall-bladder was removed was covered by drawing the cut edge of the peritoneal covering oft he liver together. The wound was carefully inspected and a stab wound made below the right costal margin through which one rubber tube drain was inserted.

The patient made an uneventful recovery, except that she coughed occasionally, and was discharged from the hospital March 19th.

In the early part of April she reported at the office, and upon examination a distinct mass was felt in the lower end of the incision She had been having considerable distress for a number of days. This mass appeared to be a hematoma, possibly infected She was sent to the hospital and that evening under nitrous-ovid and oxygen gas this mass was opened. A small amount of old blood, not infected, escaped. A tongue of omentum was adherent to the incision and that was what gave the impression of a hard mass. This unquestionably occurred within a few days after the cholecystectomy during a paroxysm of coughing. No attempt was made to close the hernial opening at this time because it was not certain whether the material was infected or not. Subsequent bacteriologic examination proved that it was not A small drain was inserted, which was removed in a few days The patient remained in the hospital for ten days until the wound was firmly healed. The result in this case brings up the question of postoperative hernias, and I wish especially to comment upon postoperative hernias occurring in the median line.

It has been my plan for many years to use the Mayo overlapping operation in hernias of this type. The technic is so well-known that the details will not be described.

This operation was originally brought out by William J. Mayo for the repair of umbilical hernia. The first paper on the subject was read before the American Academy of Railway Surgeons October 4, 1898. In that paper Dr. Mayo reported 5 cases treated by the overlapping method, three by overlapping from side to side and two from above downward. In 1903, in the Journal of the American Medical Association, Dr. Mayo reported 35 cases, 10 of which were repaired by overlapping from side to side and 25 from above downward. In this series there were no deaths

During the past winter at the Cook County Hospital I had occasion to employ this method in a number of cases of ex-

tensive postoperative hernias, with gratifying results. Where enough fascia with some muscle tissue remains to form adequate flaps, I believe this procedure should be the one of election. In very extensive cases where the fascia is thin and atrophied and there is an absence of muscle tissue, a transplantation of a large flap of fascia lata is indicated.

While there is nothing new or unusual in connection with the hernia case following cholecystectomy referred to at the beginning of this clinic it calls to mind one of the very important factors in the production of postoperative hernia, namely, the performance of surgical operations during or immediately following respiratory tract infections with severe coughing. It has been my practice for many years to keep patients in the hospital under observation for a number of days before operation in order to avoid the complication that occurred in this case.

CARCINOMA OF THE PYLORUS: RESECTION OF THE PYLORUS

MRS. I. S., aged fifty-eight, entered the hospital under the care of Dr. F. Buechner, complaining of abdominal distress occurring after meals and accompanied by vomiting of four month's duration. She stated that she felt all right before breakfast, but within an hour or two after she would feel distended and uncomfortable. This would last until the next meal. About the second day following the onset of the attack she would vomit large amounts of fluid often containing food eaten the day before. The vomitus was sour and had an odor of yeast. She was then relieved until she began to eat again, when she would have a recurrence of the attack. She has lost about 40 pounds in weight. She states that she had attacks of abdominal discomfort and at times pain in the epigastrium about fifteen years ago. At that time the pain came on about two hours after meals and she was nauseated and vomited. Soda water always relieved this distress. Bowel movement or cathartics have no effect on the present attacks. Gastric lavage performed since she entered the hospital gives considerable relief.

Physical examination was negative with the exception of tenderness in the midepgastrium and at the hypogastrium. x-Ray examination by Dr. E. L. Jenkinson revealed the following:

"The aorta is sclerosed. The posterior mediastinum is clear. The esophagus shows no pathology. The stomach is somewhat dilated. There is no filling defect in the pars cardica or pars media. There is a definite filling defect involving the pars pylorica, with an extra luminal shadow on the lesser curvature of the pars pylorica which has the appearance of a penetrating lesion. The duodenal bulb seems quite normal in out-

line There is marked residue in the stomach at the end of twenty-four hours.

"DIAGNOSIS.—Lesion in the pars pylorica which may be due to a malignancy on an ulcer base, which I believe is operable."

The diagnosis was pyloric obstruction due to ulcer, but probably malignant.

Operation was performed April 25, 1925 under local anesthesia, followed by ether Before operation it was felt that because of the patient's weakened condition only a gastroenterostomy would be performed. However, on opening the abdomen the mass in the pylorus yielded readily to removal and resection was performed The duodenum was closed by means of linen mattress-sutures put through the slit of a pylorectomy clamp This layer was then invaginated by means of a row of Lembert sutures of catgut The second row was reinforced by a row of interrupted catgut sutures The opening in the stomach was anastomosed with the beginning of the jejunum after the plan of Polya. Extreme care was exercised in suturing the stomach firmly to the opening in the transverse mesocolon, thereby precluding the possibility of hernia of the jejunum into the lesser omental cavity Resection was performed by means of stomach clamps and cautery. No glands were found in the neighborhood of the mass, and since malignancy could not be definitely established during operation only sufficient portions of the stomach and duodenum were removed to get well away from the tumor mass

I have called attention to the fact that the stomach was securely suture to the transverse mesocolon, as I believe that one of the complications that arises, either from this type of operation or from gastro-enterostomy, is due to a hernia of the small intestine through the unclosed aperture in the divided transverse mesocolon

This type of stomach anastomosis was chosen in preference to the Billroth II operation because the opening in the stomach was just of sufficient size to make the anastomosis, using the entire opening in the stomach, without partial closure of one angle This lessens the possibility of leakage and makes a very

firm anastomosis. It is a more rapid operation than the Billroth II, and since the element of time was important in this patient I employed it in preference to any other type of operation. This entire operation was done with the clamp and cautery with the field well protected, which lessens to a minimum the possibility of infection. Closure of the duodenum is a very important step and in this case was accomplished by means of linen mattress-sutures in preference to the circular ligature. The circular ligature gives a much larger stump for invagination. Firm closure avoids the danger of pancreatic fistula, which is so difficult to handle.

These cases should be as carefully prepared before operation from the standpoint of gastric lavage as is a bladder case with urinary retention. This factor is sometimes overlooked in patients with a large amount of gastric retention. This is especially true when the gastric content is acid free.

The patient is making an uneventful recovery.

The pathologic examination of the tumor mass made by Dr. L. E. Hines showed the following.

"*Gross.*—A specimen consisting of the distal 5 cm. of the stomach, the pylorus and 3 cm. of the duodenum. There is a stenosis of the pylorus such that the tip of the finger can scarcely be admitted. Adjacent to the pyloric ring on the stomach side on the posterior wall is a punched-out ulcer 1 cm. across and 0.4 cm. deep The base is red and granular. The margins are elevated and in one place blend with ovoid projection of the stomach mucosa. The mucosa of stomach and duodenum is purple but smooth. The wall of the stomach beneath the ulcer is gray with occasional yellow flecks.

"*Microscopic.*—The center of the ulcer is fibrous tissue containing a few polymorphonuclear leukocytes. The margin is deeply undermined. There is moderate hyperplasia of the glands of the mucosa adjacent to the ulcer. The ovoid projection of the stomach mucosa is composed of closely packed branching and tortuous secreting glands with very small amount of stroma. These glands and groups of glands have extended down into the muscularis in an invasive manner. The cells

lining the glands are in a single layer, the nuclei small. The lumen of the glands is small. The invasive qualities indicate malignancy.

"*Pathologic Diagnosis.*—Adenocarcinoma of pylorus of stomach; partially healed ulcer of pylorus."

CLINIC OF DR. MAURICE A. BERNSTEIN

MICHAEL REESE HOSPITAL

A CONSIDERATION OF PERIPHERAL NERVE INJURIES

J. S., age forty-two, Russian, by occupation a tailor, stumbled and fell on June 8, 1924, cutting the dorsal surface of his left wrist on a piece of glass. He went to a doctor who sewed the cut. No tendons were cut at the time of the accident. That night he had considerable pain in the wrist and arm and could not sleep on account of the "throbbing." The following day the sutures were removed and a drain was inserted. The condition, however, became worse and it was found that an infection of a violent nature developed. The axillary glands became involved and there were general constitutional symptoms of rise in temperature, rapid pulse, leukocytosis, etc. He was admitted to Michael Reese Hospital, where longitudinal incisions were made over the extensor and flexor surfaces of the forearm and wrist. When the acute inflammatory symptoms had subsided and the patient went home, his wrist began to assume a flexion contraction. He was readmitted to the hospital on July 11, 1924. Examination revealed the following:

The wrist was held in deep flexion, the three middle fingers were extended and held close together. The thumb and little finger could be moved for about 50 per cent of normal motion. Sensation was lost over the dorsal surface of wrist and for about 3 inches above the wrist upon the arm. Sensation was also absent over the three middle fingers. There was total loss of function of the three middle fingers. Passive extension of the wrist was possible, but caused much pain. Sensation was absent upon the flexor surface of the arm corresponding to that upon

the extensor surface. The median, ulnar, and radial nevres gave practically a normal electrical reflex reaction.

Let us now examine the patient's forearm and hand and see what he can do for us. You will note that he holds his wrist in deep flexion. Note also that his three middle fingers are held in complete extension The distal phalanx of the thumb can be slightly flexed and extended and a slight abduction of the thumb is also possible The proximal phalanx of the little

Fig. 389 —Photograph of patient's hand prior to any manipulation Note the extreme flexion of the wrist and extension of the three middle fingers. Note also the position of the thumb and little finger This is the typical accoucheur's hand

finger can be extended and flexed to a slight degree; abduction is also possible. We are unable to move the three middle fingers at all because there is present an interphalangeal fibrosis There is some atrophy present in the muscles of the hand and fingers. *You will note also that the hand is warm, it does not have the usual feel of a paralyzed extremity.* There is a stiffness, but not a deadness to the touch; in other words, there is no vasomotor disturbance present. You can all perhaps recall that a poliomyelitic flail foot feels dead and cold This hand,

on the contrary, has some warmth. It has a live feeling and the impression one gains from feeling such a hand is that if the patient's psychic center could be removed from his conscious self that he could move the hand. A hand like this is often treated by a Christian Science practitioner with phenomenal success. The hand, as you can see is an absolutely useless member, and because of his occupation as a tailor, the man is totally dependent on his hand for support for himself and his family. There are a very large number of such hands as a result of industrial injuries, and it becomes necessary at once to differentiate between functional and organic involvement, a task not at all easy. If the condition is an organic lesion, one must determine what nerves are injured; are the nerves severed or are they involved in an organic postinflammatory, scar; and lastly, what remedial measures will bring about a return of function? I know that most of you have been confronted with a condition somewhat the same as this, and I know, too, that you have been puzzled as to the underlying cause. I know that you have been somewhat perplexed because these cases are difficult to explain unless one has his text beside him with the sensory areas mapped out. Peripheral nerve lesions require study and one cannot draw hasty conclusions. The three nerves which cause a loss of function of the hand and wrist are the ulnar, median, and radial, the injury of one or all gives a definite clinical picture. We shall attempt to analyze each finding and apply it to the known symptoms arising from an injury to any one of these nerves. First of all, let us consider the injury that this man received. It was a transverse cut across the dorsal surface of the hand extending for about 1 inch in length, and not of great depth, since his tendons were not cut. We know that such an injury cannot of itself produce a loss of function such as this patient presents. For in order to explain the loss of function on the basis of a nerve lesion the following nerves should be injured: musculocutaneous, ulnar, median, and radial. Now that is quite unlikely. He has, however, a distinct wrist-drop which would indicate a loss of extensor muscle power. You will note that the flexor tendons are quite forcibly contracted

and are in a state of hypertonicity. When one group of muscles
has lost its normal degree of contracting power the opposing
group has no restricting influence and therefore becomes forcibly
contracted The arm and leg are maintained in a state of equilib-
rium when flexion and extension have a definite relation to one
another, that is, a normal tonus, and corresponds to the balancing
of a scale As soon as that relationship is disturbed one group
of muscles assumes control over the other and so the balance
is broken This results therefore in the various distortions
and deformities which follow a paralytic condition in which
one set of muscles only is involved. The flexor muscles are
the stronger and any weakness on the part of the extensor
group will bring about a forcible contracture of the wrist. You
have seen such a condition to a lesser degree resulting from
Colles' fracture when the wrist is permitted to assume a flexed
position. In the region of the knee-joint a similar condition
arises when the quadriceps is weak, resulting in flexion con-
traction of the knee. So in this patient the presence of a flexion
contraction of the wrist would not indicate that the musculo-
spiral nerve is paralyzed One can only say that the extensor
power is dormant, until it is proved that the nerve gives no
reaction You will also note that this patient has what is often
called the "accoucheur's" hand The thumb is adducted, the
little finger adducted and slightly opposed to the ring finger,
and all of the fingers are flexed at the proximal joints and ex-
tended at the distal joints. The three middle fingers are, in
this man's hand, in a state of flaccid inactivity. This would rule
out spasm of the deeper muscles, which control the action
Now as for the sensory disturbance you will note the peculiar
area of involvement mapped out on the dorsal and palmar
surfaces corresponding to the loss of sensation He has a loss
of sensation involving all of the ring, middle, and index fingers,
and an area extending for about 2 inches above the flexion
crease on the flexor surface of the wrist and a corresponding area
on the dorsum of the forearm. There is no loss of sensation in
either the anterior nor posterior surfaces of the thumb and little
fingers If the loss of sensation were due to injury of the ulnar

nerve, there should be a loss of sensation of the little and half of the ring finger on both sides. He has sensation over the little finger only. If the median nerve were injured, he should have loss of sensation on the palmar surface of the hand, including the inner surface of the thumb, index, middle and half of the ring finger and loss of sensation on the exterior surfaces of the

Fig. 390 —Photograph indicates the amount of sensory disturbance on the dorsal surface of the hand and wrist There is a corresponding area upon the flexor surface of the hand Note that there is a complete anesthesia both to light and pin-prick sensation of the three fingers and area on the wrist as indicated by the iodin mark The little finger and thumb are free from loss of deep or superficial sensation. This photograph was taken three weeks after immobilization and shows a return of function in the thumb and little finger. There is some movement also possible in the three middle fingers.

distal phalanges of the thumb, index, middle, and half of the ring finger. It can be seen, therefore, that the distribution of sensory disturbance does not correspond to any of the known nerve injuries or combinations of either. In this case, then, one is forced to rule out a lesion involving these nerves. We must not confound this case with a hysterical manifestation nor

with so-called malingering. This patient has an organic lesion as far as muscles, tendons and ligaments, are concerned and belongs to the class designated by Babinski as "physiopathic." The effects from an injury are often associated with loss of sensation and motion. This loss is actual and may be due to trauma of the soft tissues, exudation, and compression of nerve endings   When the tissue reaction has subsided the mental impression produced as a result of the disability may persist as a purely functional condition. This patient was examined by our neurologist, Dr. L. J. Pollack, who has contributed considerable to the literature of peripheral nerve injuries. He is also of the opinion that this patient has a functional lesion.

Peripheral nerve injuries comprise an interesting chapter in neurologic surgery, and while this case is not, strictly speaking, a nerve lesion, we may be permitted at this time to review some of the principles of treatment upon which a successful result depends. First of all, when a patient presents himself with a fracture of the middle portion of the shaft of the humerus, an examination must be made for a musculospiral nerve lesion, for you recall the nerve spirals around the humerus and occupies a groove in that bone. Often a patient is treated for a fracture of the shaft of the humerus and it is discovered, when the cast is removed several months later, that an injury to the musculospiral nerve has occurred. To repair such a nerve complicates matters considerably, since a neuroma has developed at the ends of the nerve, causing a fibrosis of the ends of the nerve filaments with a degenerative process extending for a considerable distance from the cut end   When a nerve is sutured immediately after the injury the results are much more favorable. The musculospiral nerve gives the most satisfactory results when sutured early. Second, when a patient presents himself with a cutting injury, to the flexor surface of the wrist, and it is learned that the wrist tendons are cut, one must find the median nerve before a suture of the flexor tendons of the wrist is attempted. Not infrequently has the median nerve been sutured to the distal end of a cut flexor tendon. The median nerve can easily be mistaken for a tendon when these are cut

across, for they do look much alike. It is advisable, therefore, when dealing with the transverse cuts of the wrist to convert the same to a longitudinal incision and to isolate each and every tendon, tracing it to its muscular junction and, second, to pull upon the distal portion to ascertain if the tendon produces a movement of the finger. In this manner the above-mentioned accident can be avoided. Third, when dealing with a severed nerve, when a defect in the nerve had occurred, it is important to suture the nerve without much tension. It is therefore advisable to flex this joint in the neighborhood of the nerve to bring about an approximation of the nerve and to maintain that position until the nerve is healed. Fourth, when the repair of an old nerve lesion is attempted the manner of suture and preparation of the nerve for repair is important. The neuroma which forms on the end of the nerve must be removed by a sharp cutting instrument, preferably a razor blade, until healthy funiculi are visible. It must be emphasized that nerve impulses will not pass through connective-tissue scar. The end thus freshened must be very closely approximated and sewed with very fine silk through the neurilemma; the suture must not run through the nerve proper. One must particularly avoid transverse sutures, for these will invariably cut off nerve fibers. It is often advisable to encircle the sutured nerve with a piece of fascia or fat, to prevent adhesions of the nerve to the surrounding tissue. The extremity must be immobilized to prevent traction upon the newly sutured nerve and asepsis must be carried out to the superlative degree. Loss of sensation after complete division of a peripheral nerve is often limited to a much smaller area than would be expected from its anatomic distribution. It has been found clinically that when a peripheral nerve has been injured the sensory symptoms may disappear, and the finer tests, such as stroking the area supplied by that nerve or pin prick, may be felt by the patient over the area where one would expect it to be absent, that is, the area corresponding to the anatomic distribution of that nerve. The appreciation of pain is not due to a transmission of sensory impulses through the divided nerve, but is

with so-called malingering. This patient has an organic lesion as far as muscles, tendons and ligaments, are concerned and belongs to the class designated by Babinski as "physiopathic." The effects from an injury are often associated with loss of sensation and motion. This loss is actual and may be due to trauma of the soft tissues, exudation, and compression of nerve endings. When the tissue reaction has subsided the mental impression produced as a result of the disability may persist as a purely functional condition. This patient was examined by our neurologist, Dr. L. J. Pollack, who has contributed considerable to the literature of peripheral nerve injuries. He is also of the opinion that this patient has a functional lesion.

Peripheral nerve injuries comprise an interesting chapter in neurologic surgery, and while this case is not, strictly speaking, a nerve lesion, we may be permitted at this time to review some of the principles of treatment upon which a successful result depends. First of all, when a patient presents himself with a fracture of the middle portion of the shaft of the humerus, an examination must be made for a musculospiral nerve lesion, for you recall the nerve spirals around the humerus and occupies a groove in that bone. Often a patient is treated for a fracture of the shaft of the humerus and it is discovered, when the cast is removed several months later, that an injury to the musculospiral nerve has occurred. To repair such a nerve complicates matters considerably, since a neuroma has developed at the ends of the nerve, causing a fibrosis of the ends of the nerve filaments with a degenerative process extending for a considerable distance from the cut end. When a nerve is sutured immediately after the injury the results are much more favorable. The musculospiral nerve gives the most satisfactory results when sutured early. Second, when a patient presents himself with a cutting injury, to the flexor surface of the wrist, and it is learned that the wrist tendons are cut, one must find the median nerve before a suture of the flexor tendons of the wrist is attempted. Not infrequently has the median nerve been sutured to the distal end of a cut flexor tendon. The median nerve can easily be mistaken for a tendon when these are cut

in surface extent of the loss of sensation to the pin prick which follows division of those nerves, according to Quaites, Head, and Scherran, who state that, "the consequence of both division and irritation of these nerves shows that as far as protopathic sensibility is concerned they overlap to an enormous extent." It becomes evident therefore, when testing for loss of sensibility, that the areas of overlap are of great importance for pin prick, that is, appreciation of deep pain.

It may be stated, with a great degree of assurance, that the return of sensation to pin prick, which occurs before the return of sensibility to touch, takes place in those areas occupied by nerve overlap. *The return of such sensation must not be attributed to nerve regeneration.* When a nerve is divided, and at the same time when one or more adjacent nerves are injured, sensation to pin prick does not return in the area of overlap of these nerves. When a nerve is injured adjacent to one which is divided, the pre-existing sensibility to pin prick in the overlap area is lost. Now regarding return of function in a sutured nerve, Dean Lewis, who has had an extensive experience with peripheral nerve injuries, states that the musculospiral gives the best response to recovery; the median and ulnar the next, and the external popliteal the least.

Treatment.—The treatment of these "physiopathic" cases is extremely difficult and requires a great deal of patience and belongs strictly to the physiotherapist.

The first thing to do with this wrist is to place it in the most favorable position for the return of function in the muscles; that would be a hyperextension. A gradual correction of the deformity is perhaps the best method of treating this wrist. He has, however, so much deformity that it would be advisable to put him to sleep and straighten the wrist. The hyperextension can be accomplished later on by inserting felt pads. You will note from the accompanying illustration the position of the correction which was accomplished thus far. His hand will be removed from the splint and massage carried out each day, accompanied by light faradization. It must be emphasized that strong faradism and galvinism is a procedure to be condoned.

CLINIC OF DR. GOLDER LEWIS McWHORTER

Oak Forest Infirmary Hospital

FRACTURE OF THE GREATER TUBEROSITY OF THE HUMERUS WITH DISPLACEMENT. REPORT OF TWO OPERATED CASES WITH AUTHOR'S TECHNIC OF SHOULDER INCISION.

FRACTURES of the greater tuberosity of the humerus are more common than generally believed. In most instances the fragment is not completely separated and there is little or no permanent disability.

I am going to demonstrate two patients with marked disability due to a displaced fractured tuberosity. The first one I operated two months ago The second I am to operate at this time. In neither of these cases was this fracture recognized.

The first patient, P. M., was unable to use his right shoulder following a dislocation about a year and a half ago, which was reduced at that time.

While the patient was walking home from his work on the railroad he stumbled and fell, striking his shoulder against the rail. He does not remember whether his arms were up or against his sides. He was taken to a hospital, where a dislocation of the shoulder was found and reduced. The arm was put in a sling for a few days and he was then told to use it.

Although the patient was a large, well-muscled male of sixty-three years, who had been doing heavy work, he was not able to get any motion in the shoulder-joint and it was painful on attempted use. He was incapable of earning his livelihood on account of this injury.

On inspection posteriorly there was a normal rounded prominence of the shoulders. There appeared to be a forward and inward rotation of the head of the humerus. There was

some flattening of the shoulder posteriorly, which made one think of a subluxation   There was marked atrophy of the supra-spinatus, infraspinatus, and teres minor muscles as compared to the other shoulder.   There was no disturbance of sensation over the shoulder or arm, which ruled out any very extensive brachial plexus injury.   On attempted abduction the patient elevated the right shoulder, moving the scapula, but there was no abduction in the joint itself.   On attempted external rotation, the scapula alone moved   Internal rotation of the arm was present and seemed a little spastic.   Flexion and extension of the forearm were present   On passive motion abduction was limited and painful   External rotation was also limited and painful. On palpation over the prominence of the shoulder there was a rubbing sensation beneath the deltoid.   This did not feel like bone crepitus

Since there was some motion between the humerus and the scapula we ruled out an arthritis and considered that there was some extra-articular condition present.

The three muscles which insert on the greater tuberosity were evidently atrophied from disuse, because the nerve supply to the supra- and infraspinatus muscles comes from the supra-scapular nerves, while the nerve to the teres minor comes from the axillaris nerve, which supplies the deltoid

There was no sensory disturbance of the nerve and no del-toid paralysis.   The atrophy of the deltoid was not very notice-able, but is usually present in these cases.

The inability to abduct with the deltoid was probably due to the impingement of the fragment between the acromion process and the head of the humerus.

The forward inward rotation of the head of the humerus was due to the loss of the external rotators and abductors which hold the head in place, with hyperactivity of the internal ro-tators.

Roentgenograms (Fig. 392) taken a little over a year ago on entrance to the infirmary showed the head in the glenoid cavity.   The outline of the upper end of the humerus was clean cut, but over the head of the humerus one could see a definite

rarefied area resembling a cavity. This area was quadrilateral; had it been round, it might have been mistaken for cystic changes in the bone. Somewhat medially to the cavity there was a poorly defined shadow (Fig. 392, A).

Lovett[1] states that in cases of detachment of the supraspinatus tendon with a bone fragment the cavity made in the bone can generally be detected in the roentgenograms.

Roentgenograms taken just before the operation showed quite a different picture (Fig. 393)
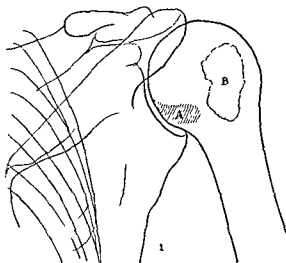
Fig 392 —Roentgenogram of Case 1 about two months after the injury. The bone fragment A is very poorly defined The rarefied area B is where the greater tuberosity bone fragment has been detached With the arm flexed this injury might easily be overlooked, as the greater tuberosity region overlaps the head and the bone otherwise is normal

There was a definite bone fragment medially and posteriorly to the head of the humerus. The outline of the upper part of the surgical neck was quite irregular. Phemister[2] emphasizes the necessity of making roentgenograms with the arm in adduction and external rotation. Otherwise the tuberculum majus overlaps the head and fractures are easily overlooked.

Brickner[3] states that the shadow of the fragment may resemble a calcareous deposit. This is more likely to be confusing where there is only a small bone fragment detached with the supraspinatus tendon without much displacement.

It is difficult to say just how much function we may expect from an operation after about one and one-half years of disuse, with atrophy of the muscles In the few operated cases reported the fragment has been re-attached to the humerus by nailing it or by sutures. There are very few late reports, but improvement resulted in those cases The lateral and posterior methods of approach were used

Keene[4] used the lateral incision, which extends down from the acromion and splits the deltoid only in the upper part on
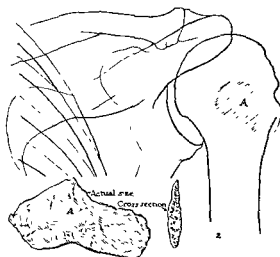
Fig. 393 —Roentgenogram of Case I one year later The region of the greater tuberosity is now in profile and is seen to be quite irregular The bone fragment A is clearly outlined The insert A is the fractured greater tuberosity which was removed at operation

account of possible injury to the axillaris nerve and the exposure is not very adequate.

There are two well-known methods of posterior approach to the shoulder-joint Phemister employed the Kocher method in his case An angular incision is made from the tip of the acromion backward over the entire length of the spine of the scapula and then downward along the posterior border of the deltoid, after which an osteoplastic resection of the deltoid with

a strip of bone about 1 cm. thick is made from the spine and the acromion.

In the Robert Jones[5] method the incision extends through the acromioclavicular articulation and crosses posteriorly below the spine of the scapula at the origin of the acromion process, which is divided with a Gigli saw. The deltoid is turned out and down. Phemister says that, although easily performed, the osteoplastic flap in Kocher's method is a more extensive operative procedure and in the event of an infection would give a more formidable condition with which to deal. There are the same objections to the Jones method.

Case I.—The incision which I used was one which I have not seen described in the literature. It avoids the objectionable osteoplastic procedure and still gives ample exposure by cutting through the deltoid posteriorly and laterally. I am going to describe in detail this original method of posterior approach to the shoulder-joint as used here.

The incision was somewhat curved as it followed around the lower border of the spine of the scapula and the acromion process (Fig. 394, a).

The medial end extended rather sharply downward in order to permit the deltoid to be retracted. The origin of the deltoid was cut through along the spine of the scapula and as far forward as the tip of the acromion, but about 1 cm. was left attached to the bone for suturing (Fig. 394, b). The greater part of the deltoid was retracted downward, exposing the posterior and lateral part of the shoulder-joint and upper end of the humerus.

The supra-infraspinatus and teres minor muscles in this case were seen to be considerably atrophied. The branch of the suprascapular nerve comes around the base of the acromion process to supply the infraspinatus muscle. At the lower border of the teres minor there were several vessels with a branch of the axillaris nerve going to it which were carefully avoided.

There was a large fragment of bone from the greater tuberosity back of the joint. It had apparently been displaced

by the retraction of the attached tendons of the supra- and infraspinatus and the teres minor muscles. The fragment

a

b

Skin incision

Vess & N

c

Incision through deltoid attachment

Deltoid

Bone shell

d

Teres minor

e

Tuberculum maj. in line with lat. condyle
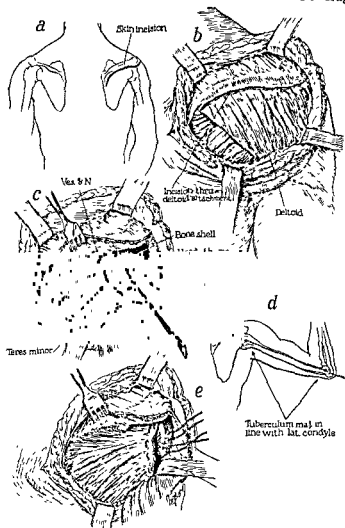
Fig. 394 —Author's incision beneath the spine and acromion process of the scapula Technic of exposure and rotation of the arm externally for re-attachment of the muscles

was movable but no crepitus was felt. On cutting laterally to the fragment the joint was opened and it was found to form a part of the posterior capsule (Fig 394, *c*). Because of the

large size of the bone fragment and the inadvisability of freshening up its normal location I decided to remove it and to suture the tendons in position. I chose this method because I did not like to introduce nails or foreign substances.

I saw several strands of quite heavy torn tendon extending into the joint from the site of the greater tuberosity. This was easily located by flexing the arm and locating the lateral epicondyle which should be in line with the greater tuberosity (Fig. 394, *d*). These tendon strands came from the region anterior to the greater tuberosity. It was these torn tendons which gave the grating sensation underneath the capsule previously noted.

It is probable that they were a part of the torn supraspinatus tendon, although the bone fragment was still attached to all three muscles. Codman[e] frequently found the supraspinatus tendon frayed out in dissecting room subjects. Lovett stated that it was not infrequently ruptured alone.

The supra- and infraspinatus and teres minor muscles were somewhat contracted and I loosened them carefully to avoid injury to the vessels and nerves. With the arm held externally and abducted I placed mattress-sutures of chromic catgut through the fibrous capsule and lacerated tendons and sutured the supra- and infraspinatus and teres minor muscles under tension in this position (Fig. 394, *e*). I reinforced these with several extra sutures through each of the tendons after the method of von Frisch. This closed the capsule of the joint tight and it was a simple matter to replace the deltoid muscle and suture its cut tendinous origin with a few mattress and continuous catgut sutures. I put a body arm cast on with the arm still held in abduction and rotated externally so that the forearm was almost straight upward.

The bone fragment (Fig. 393) from the greater tuberosity was 4 cm. long and 1.5 to 1.75 cm. wide. It varied from 0.25 to 0.5 cm. in thickness. Grossly, the under surface which had been in contact with the head of the humerus was covered with cartilage.

Postoperative Course.—There was primary union of the wound

and no complications. The part of the cast over the shoulder and arm was removed at the end of two weeks. The remainder was left as a support under the arm for five weeks. At the present time he has some abduction of the arm and external rotation. The muscles are still weak, but they are apparently getting stronger, and he has no pain on motion.

Case II.—This patient, G. R., aged sixty-six years, four weeks ago fell backward off a street car and struck on his

Bone fragment
removed from
Case II
Actual size
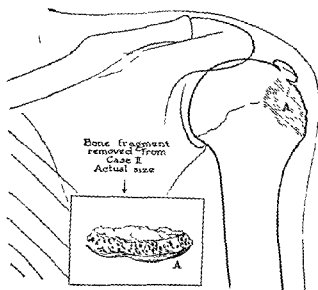
Fig. 595—Roentgenogram of Case II one month after the injury. The bone fragment is shown from the end and therefore appears smaller than the cavity in the humerus. The displacement is upward since only the supra- and infraspinatus tendons are detached.

shoulder. There was immediate loss of function with pain in the shoulder. He had some numbness in his fingers, but was able to move them. He was taken to a hospital where the examining doctor diagnosed a subglenoid dislocation. The head was stated to be outside of the glenoid cavity and high up in the axilla. There were no fragments palpable and no crepitus was noted. Other findings were reported normal.

On examination I found almost complete inability to use the right arm. There was a deformity of the shoulder due to atrophy of the deltoid, the supra- and infraspinatus muscles. The patient was unable to abduct the arm and complained of pain on attempted motion. Passive motion was also painful and limited. There was a small mass palpable just below the acromion process, which was somewhat tender. There was no apparent sensory nerve disturbance or anesthesia. A roentgenogram (Fig. 395) showed a rarefied area at the site of the greater tuberosity and a small fragment of bone about 1 inch above and medial. The atrophy of the deltoid was probably that of disuse on account of pain due to the impingement of the fragment between the head and the acromion process on attempted abduction, since there was no sensory disturbance. The supra- and infraspinatus muscles had atrophied, probably due to detachment of the greater tuberosity fragment.

Operation.—The patient is in good general condition, but I am going to use local anesthesia on account of his age. He has had $\frac{1}{4}$ grain of morphin. I am using nerve-block anesthesia around the operative field, which extends about the scapula border and laterally some distance over the shoulder. The solution is $\frac{1}{2}$ per cent. of procain with 3 drops of adrenalin to the ounce. The incision and technic of exposure are the same as employed in Case I. On retracting the deltoid the small mass which was felt is found to be the detached bone fragment from the greater tuberosity. It is covered entirely by fibrous tissue and tendons, but is slightly movable. There is no crepitus. On freeing it laterally the fragment is found to form a part of the capsule of the joint, which is opened. The bone fragment is larger than appears in the roentgenogram, but this is probably due to the film showing only its width. The cavity as seen in the film gives a better idea of the size of the fragment. The supra- and infraspinatus muscles have retracted this fragment upward and slightly backward. The teres minor muscle is intact throughout.

The cavity in the humerus is indistinct and largely filled in with granulation tissue. Failure to hold the fragment in

place properly will produce a recurrence of disability. Removal of the fragment will permit normal deltoid and teres minor action; therefore I am excising the bone fragment Proper suture of the tendons should restore complete function to the shoulder in the absence of adhesions The supra- and infraspinatus muscles can be rather easily stretched out and by abducting and externally rotating the arm I am able to bring the tendons well over their original site on the humerus. On account of the difficulty of getting a firm suture hold I am drilling a hole through the cortex of the humerus just below the cavity. With chromic catgut passed through this hole and sutured in the tendons after the von Frisch method I am fastening them solidly in their original position. This is reinforced with a few more sutures about the capsule which closes it securely and imbricates it. The deltoid muscle is drawn up and sutured with a separate suture along the inner and outer fascial layers. The skin is closed carefully. While I put on the cast holding the arm in abduction and external rotation. the patient is sitting up on the table.

The removed fragment is 2½ cm long, 1½ cm. wide, and ½ cm thick The under surface is fairly smooth, the edges appear as if freshly fractured and the upper surface is covered with tendon fibers There is no gross evidence of any callous formation

Because of the short time, one month, which has elapsed since the injury, even though there is considerable atrophy of the shoulder muscles, I expect to get a good return of function. These muscles are still very elastic and quite different from the supra- and infraspinatus muscles in Case I, in which it will take considerable education and use to get a return of their function, but the patient already has some use of the arm, which was not possible before removal of the fragment Postoperative course of Case II uneventful He developed good use of the arm and left the institution, going to work two months after operation.

DISCUSSION

Fracture of the greater tuberosity may occur as an isolated injury or associated with other lesions, such as dislocation of

the shoulder or fracture of the surgical neck. The cause of isolated fracture is usually due to direct violence. After severe exertion, as in golf, Lovett found complete or partial rupture of the supraspinatus tendon or, frequently, a detachment of a small piece of bone. Unless recognized and treated, usually by abduction, he says there is usually inability to abduct without discomfort and a dragging sensation frequently referred to the outer side of the arm. Stimson[7] says that the line of greater tuberosity fracture usually runs along the sulcus, marking the anatomical neck at the point where it adjoins the tuberosity and then down the bicipital groove. He believes that unless associated with other fractures it is due to the action of the muscles. Gurlt[8] in 1862 collected 41 cases from the literature. Thirty were associated with dislocation. Three were isolated fractures and 8 included fracture of both tuberosities.

Schlaepfer[9] found a fracture of the greater tuberosity in 8 of 120 cases of dislocation of the shoulder, or 7.4 per cent. In 7 of these cases it did not interfere with healing. This is apparently due to the fact that the fragment in most cases is not entirely separated from its fibrous attachments and remains in its normal position.

Gubler[10] found that a fracture of the greater tuberosity was the most frequent complication, occurring eighteen times, or 7.1 per cent., in 252 dislocations. Other bone complications occurred in 10 cases, or 3.9 per cent.; nerve injuries occurred in 10 cases; nerve and bone injuries occurred together in 2 cases, or 0.8 per cent. Finckh[11] found a fracture of the greater tuberosity four times in 223 dislocations.

It is interesting that in the 16 cases of Schlaepfer's series of dislocations which were not diagnosed until late, there were 5 which had an associated fracture of the greater tuberosity.

Cotton[12] says that in cases with a separation of the greater tuberosity with dislocation there is no change in the method of reduction. However, he uses the abducted position as a safeguard against a separation of a bone chip that might later give great limitation of movement by its contact with the

acromion on attempted abduction   This will also tend to
prevent the formation of subdeltoid adhesions.

Speed[13] advises treatment by abduction with the arm up
over the head for three weeks.

Judet[14] states that reduction of the dislocated humerus must
not be done by Kocher's method because of the inefficiency of
capsular and tendinous fixation   He uses the traction method
with the arm in abduction

CONCLUSION

1   This posterior method of approach to the shoulder-joint
has proved very satisfactory

2. The removal of the detached greater tuberosity bone
fragment, except perhaps in very early operations, is to be
recommended.

3. It is preferable to suture the detached tendons in position
without using a foreign non-absorbable suture or nail.

4. This operation may be done satisfactorily under a local
anesthesia.

5. In dislocation of the shoulder, especially following direct
injury, the patient should be examined for a fracture of the greater
tuberosity before reduction, in order to institute proper treat-
ment.

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CONCLUSION

1 This posterior method of approach to the shoulder-joint has proved very satisfactory.

2. The removal of the detached greater tuberosity bone fragment, except perhaps in very early operations, is to be recommended.

3. It is preferable to suture the detached tendons in position without using a foreign non-absorbable suture or nail

4. This operation may be done satisfactorily under a local anesthesia

5. In dislocation of the shoulder, especially following direct injury, the patient should be examined for a fracture of the greater tuberosity before reduction, in order to institute proper treatment.

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OLD UNREDUCED DISLOCATION OF THE SHOULDER. REPORT OF OPERATIVE CASE WITH RESECTION OF THE HEAD OF THE HUMERUS.

THE long duration of the unreduced dislocation makes the operative findings and result in this case of unusual interest.

This patient, P. A., sixty-four years of age, fell off a chair two years ago while under the influence of alcohol. He did not know whether he struck his shoulder directly against the floor or whether he fell with his arms up. The patient did not go to a doctor, but after a few days returned to work as a compositor, although he had considerable aching in his shoulder. There was pain in his shoulder and arm, which became worse in the last eight months. This has been largely the cause of his not working the last year, although work has been hard to get on account of his age.

On examination we find a fairly well-developed male. There is a deformity of the right shoulder which consists of a flattening beneath the acromion. The head of the humerus can be palpated anteriorly and just below the coracoid process. There is a coarse crepitus felt here on rotation of the head, which is painful

There is about 20 degrees of abduction of the arm, but flexion and extension of the forearm are not interfered with. Dugas' sign for a dislocation of the shoulder is positive.

There are no motor or sensory nerve disturbances. These were looked for particularly about the axillaris nerve because the paralysis of the deltoid muscle would be an indication for an ankylosis of the shoulder in the position of election.

The roentgenogram (Fig. 396) shows an anterior subcoracoid dislocation of the humerus. There is no bone formation in the soft parts, which would tend to contraindicate an operation.

I am going to operate after this period of two years' time on account of the pain and disability. It would be dangerous to attempt to reduce the dislocation without an open operation

because of possible injury to the blood-vessels and nerves, especially in so old a person.

Operation.—The incision extends from a point just lateral to the coracoid longitudinally downward. The anterior fibers of the deltoid are split in their upper portion and retracted. The head of the humerus gives a crepitus on rotation, due to rubbing against the coracoid
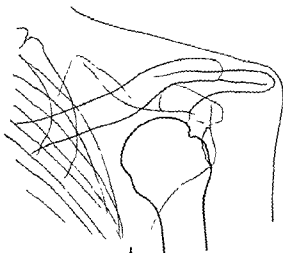
Fig. 396.—Roentgenogram taken two years after an anterior unreduced dislocation of the shoulder. There are no other apparent changes or new bone formations.

I am dissecting free the long head of the biceps tendon and retracting it. The supra- and infraspinatus muscles are seen, the latter drawn tightly across the neck of the glenoid. The teres minor is stretched across the glenoid. After cutting the insertions of these muscles and fibrous tissue about the head it still resists replacement.

By rotating the head of the humerus I am able to cut the subscapular muscle insertion and adjacent fibrous tissue. This permits it to be freed and delivered through the incision

The glenoid cavity is covered by a tightly adherent fibrous sheath, probably the old capsule. On splitting and pushing this off there is a small flat surface exposed. The cartilage

appears to be still intact, apparently protected by the fibrous tissue capsule.

It is evident that the muscles are so shortened that the head cannot be replaced, and I am resecting it with a Gigli saw just below the tuberosities. The lower border is a little sharp and I am rounding it off with a bone forceps. It is now possible to place the end of the humerus against the glenoid surface, with the arm in abduction. The humerus is held in place by suturing the tendons of the supraspinatus, infraspinatus, teres minor, and the subscapularis to the tendinous insertion of the pectoralis major. The fibers of the deltoid which were separated, only in their upper portion to avoid nerve injury, are now sutured. The skin is now closed. The arm has been held up almost at right angles to the body, with the forearm horizontal and in front of the chest, while I have put on a body arm plaster cast spica well reinforced under the axilla and arm.

There is no gross change in the sectioned head or cartilage which covers it. There is apparently a slight arthritic rim about the head.

Postoperative Course.—There was uneventful healing of the wound. The upper half of the cast was removed from the shoulder and arm at the end of two weeks, leaving the support under the arm. A roentgenogram (Fig. 397) three weeks after operation, showed the resected upper end of the humerus restored in the glenoid cavity. The cast support was removed entirely at the end of one month. The patient was instructed to use the arm as much as possible. Brickner's method of intermittent abduction by tying the arm to the head of the bed was started. There was active abduction of about 50 degrees in the shoulder-joint and the arm could be raised to a right angle with the body by passive motion.

Discussion.—Shoulder dislocations are most common in middle age and rare in children. Schlaepfer[1] found that 66 per cent., Finckh[2] 79 per cent., and Krönlein[3] 50 per cent. of shoulder dislocations occurred in patients from forty-one to eighty years of age. There was only 1 case under ten years of age in 550 collected cases. Finckh found in his series, that 81

per cent occurred in males and that 97 6 per cent were anterior dislocations Ninety per cent of these were subcoracoid displacements.   There were 8 prescapular, 2 subclavicular, and 1 luxation erecta.   Of the 5 posterior dislocations there were 2 subspinal and 3 subacromial.

Schlaepfer stated that falling on the shoulder with dislocation produced by direct trauma was responsible in the majority of his 120 cases Others have found that the arm has usually been hyperabducted and rotated slightly outward when dislocation occurs

A subluxation may occur, according to Brickner,[4] although it is rare. He describes the deformity as a flattening of the deltoid with a depression behind and inability to abduct the arm It is reduced by abduction and splinting in this position for ten to fourteen days

Old dislocations may form a new glenoid cavity of bony tissues, surrounding adhesions, and shortening of the soft parts. In the absence of new bone formation open operation may be indicated

Robert Jones[5] states that an operation may be performed for an unreduced dislocation of the shoulder in which the function can be improved and to relieve pressure on nerves or vessels He has had no perfect results, since some stiffness, ankylosis, or periarticular adhesions usually result

Cotton[6] states that excision of the head gives a joint so weak as to be of no great use except for elbow and forearm work Useful abduction is not the rule, he says, since the head is a necessary fulcrum; however, he admits that the tendons usually re-form their attachments to the humerus.

Before excision of the head in these old dislocations we may well consider the following general rules laid down by Robert Jones for arthroplasty of the shoulder in cases of ankylosis

CONDITIONS ARE FAVORABLE FOR MOBILIZATION.—1. Where the deltoid muscle is acting well

2. Where the contour of the head is not obliterated

3. Where mobility but not strength is desired

4. Where the glenoid and acromion are absent

CONDITIONS ARE UNFAVORABLE FOR MOBILIZATION.—1. Where the function of the deltoid or of the muscles attached to the tuberosities is destroyed.

2. Where there is a mass of bone in the axilla.

3. Where strength is preferred to mobility.

4. Where ankylosis exists in good position.

In operating on old dislocations, Bazy[7] uses an anterior T incision and cuts the clavicular origin of the deltoid and the pectoralis major muscles, in order to obtain more room. He found that the subscapular muscle was the chief obstacle to reduction in his case, but after replacement of the head in the glenoid, he re-attached it to the lesser tuberosity.

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DISCUSSION OF OTHER COMPLICATIONS OF SHOULDER DISLOCATIONS, WITH REPORT OF A CASE WITH MULTIPLE NERVE INJURIES

BEFORE discussing other complications, I wish to present this patient, O. S., with multiple nerve injuries. This man, aged fifty-four years, one year ago tripped and fell over a low fence about a street parkway. He was carrying a bundle and fell, striking his shoulder against the top of the fence. He thinks his arm was up at the time.

He went to a hospital where they found a dislocation of his shoulder, this was reduced under ether. His arm was placed in a sling for two days, when he was instructed to use it.

There has been practically no sensation in the fourth and fifth fingers, nor strength in the forearm and hand, he says, from the time of the injury. Ever since then the fingers get cold easily and the ulnar part of the forearm feels peculiar.

This case is very interesting to compare with the others presented to you. They all have deformities about the shoulder, but they are all different in character and degree; however, all are complications of a dislocation of the shoulder.

On examination we see a well-developed large male with a deformity of the left shoulder, unable to abduct the arm. The prominence beneath the acromion is gone. This is not due to a dislocation as in the last patient, since the roentgenograms show the head in the glenoid cavity. Placing the elbow against the chest with the fingers on the opposite shoulder produced, to my surprise, an apparently normal fulness laterally over the shoulder. I took roentgenograms in both of these positions and found that the head was separated from the glenoid cavity by the leverage action of the lower end of the humerus pressed over a prominent chest. This is a flail shoulder-joint and it is due not only to paralysis of the deltoid which is markedly atrophied but also, apparently, to the supra- and infraspinatus muscles, which are atrophied. The teres minor is apparently functioning

and there is no spastic internal rotation as in the patient with separation of the greater tuberosity. There are no fragments of bone seen here in the roentgenogram, and because of other nerve injuries it is probable that the atrophy of the supra- and infraspinatus muscles is also due to a paralysis. There is no anesthesia demonstrable over the region of the axillaris nerve, which supports my belief that there is here a preservation of the branch to the teres minor. The muscles of the anterior and posterior axillary folds formed by the pectoralis major and the latissimus dorsi are quite spastic. This spasticity permits practically no abduction of the arm.

On examining the forearm and hand there is seen to be a typical atrophy and weakness of all of the muscles in the hand supplied by the ulnar nerve, but this is not quite complete as there is no so-called claw hand or "main en griffe."

There is atrophy of the ulnar group of muscles of the forearm and weakness of the third, fourth, and fifth fingers. Sensation is diminished over the part of the hand supplied by the ulnar, but it is not entirely gone. There is no disturbance of the median and radial nerves.

There is apparently a brachial plexus injury here, involving multiple nerves. It is quite possible that there has been some return of sensory and motor function since the injury. Most authors state that there is usually partial or complete return of function following nerve lesions after dislocations of the shoulder. Naturally the amount of return of function will depend upon the character and extent of the injury. This patient refuses any surgical treatment.

Cotton states that damage to nerves is common in shoulder dislocations.

Finckh reports 7 cases of nerve lesions in 223 dislocations. Paralysis was present in only 2 of these and they improved later.

Holm,[8] in 112 dislocations, found 7 cases of multiple paralyses of the muscles of the arm and 10 with deltoid paralysis alone

Tubby and Jones[9] collected 38 cases of nerve and blood-vessel injury associated with dislocations. Twenty-nine had been reduced by the heel in axilla method, 5 had not been

reduced, and the others were complicated by other injuries. Where the nerve injury is due to the dislocation it may be due to a thrust of the head crushing them against the scapula or the thorax, to a pulling avulsing force, or to a stretching of the nerves over the head. The last is probably the most common cause in lesions of the axillaris nerve.

Cotton believes that the plexus injuries in dislocations are due to a pull on the plexus, as in obstetric nerve paralysis. He cites 10 operated cases of nerve injury with no benefit in 4 of them from treatment. Recently Smith and Christiansen[10] reported 2 cases of axillaris nerve paralysis from direct shoulder injuries They found complete rupture of the nerve and sutured the ends. Improvement resulted after a short period of observation.

Schlaepfer reported 3 cases of multiple nerve paralysis out of 120 dislocations.

Gubler[11] reported 12 instances of nerve palsy out of 252 dislocations.

The importance of diagnosing a nerve lesion makes it necessary to test the sensory and motor function before attempting reduction of the dislocation.

As to the hope of improvement with an operation in brachial plexus lesions, it is the experience of most operators that the results are not entirely satisfactory. In a study of the end-results of nerve suture recently, Dean Lewis and Miller[12] found that the operations on plexus injuries gave the poorest results of all nerve sutures for injuries in civil life. The few good results reported where improvement has resulted after operation justify exploration and an attempt to repair the injury.

In discussing operative procedures for improvement of a flail shoulder such as this, one must consider an arthrodesis operation, first reported by Albert[13] in 1878.

Straub[14] reported a case of deltoid paralysis with successful arthrodesis of the shoulder-joint, using a bone peg, which resulted in a useful shoulder.

Robert Jones says that, with a movable scapula, the position of election for ankylosis is with the arm abducted 60 degrees

and with the elbow a little in front of the midaxillary line. The arm should not be rotated too much outward

Jones and Lovett[15] say that one should not perform an arthrodesis before fifteen years of age. Between the ages of fifteen and eighteen years the scapula is very mobile and this is the most favorable time. In adults, they state it is difficult to mobilize the scapula.

Many operators report difficulty in getting an ankylosis. However, Asplund[16] recently reported a satisfactory ankylosis in 7 out of 8 patients, where he simply removed the cartilage with fixation of the arm for four to six months. In only one instance was there a poor result due to a fibrous ankylosis. In this patient there is not only a paralysis of the deltoid, but a loss of function of the supra- and infraspinatus. He has a flail shoulder with a movable scapula and undoubtedly he would be benefited by an ankylosis with the arm in the position of election. Some difficulty would be met with in the spastic latissimus dorsi and pectoralis major muscles, and the hand would be weak from ulnar paralysis.

In reducing dislocations of the shoulder, I condemn the heel in axilla method and can see no advantage in using the Kocher method. It is possible frequently to place the dislocated arm in the position it was when dislocated, that is, hyperabduction and slight outward rotation, and then by gentle but firm traction relax the muscles so that the head slips back into place by practically reversing the force and process of the dislocation as advocated by Bevan. I practically never use anything but morphin for recent dislocations. Gentle handling will permit reduction without a general anesthetic in most cases. The idea of replacement of the head with a quick snap and jerk is obsolete. I know of a number of broken arms resulting from attempts to reduce by the Kocher method. However, it is the placing of the head in the proper position and the obtaining muscular relaxation by gentle handling, proper traction, and manipulation, which permit a proper reduction.

After treatment it is usually advisable to carry the arm in a sling for a week and then allow active use of the arm.

However, there may result a decreased abduction of the arm due to arthritis or adhesions, especially in older people. In younger people a common disturbance is due to a periarthritic bursitis. This may occur in any of the bursa, the subdeltoid being the most common. There may be a tenosynovitis of the long head of the biceps tendon.

Schulz[17] found that there was normal function in only 13 per cent. of fifty-four uncomplicated reduced dislocations. In 61 per cent. of these the result was poor, with a disability of over 30 per cent , and in some over 50 per cent.
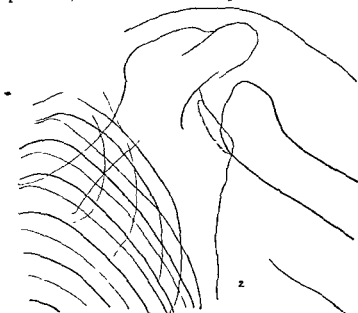
Fig 397.—Roentgenogram which was taken three weeks after resection of the head of the humerus.

De Marbaix,[18] in 1910, instituted a functional method whereby active and passive movements were instituted immediately after reduction. He reported that 97 per cent. of uncomplicated cases were working in eighteen days. Three of his cases showed arthritic changes. Gubler reported 94 per cent. of uncomplicated cases without disability, but in the complicated cases there were only 70 per cent. without disability. The healing time averaged thirty-eight days.

Conclusions.—1. Dislocations of the shoulder are commonly overlooked.

2. Old unreduced dislocations unless contraindications exist should be operated

3. Improvement in function may be expected even though resection of the head is necessary.

4. Nerve injuries and other complications frequently exist with dislocations.

5. A careful examination and roentgenograms should be made in all patients with dislocations before reduction

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CLINIC OF DR. RALPH BOERNE BETTMAN

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REPORT OF TWO MEDIASTINAL TUMOR CASES: (1) HODGKIN'S DISEASE IN THE ANTERIOR MEDIASTINUM; (2) CARCINOMA OF THE INTRATHORACIC PORTION OF THE ESOPHAGUSIN THE POSTERIOR MEDIASTINUM

I AM presenting today 2 cases of mediastinal tumors, one of the anterior and the other of the posterior mediastinum to emphasize the important lessons to be learned from this most interesting thoracic condition.

Case I.—The first case is that of a boy, six and a half years old, who came to the hospital on the service of Dr. I. A. Abt, with the following history.

His mother stated that three months previously the boy complained of pain in his right leg, particularly in the knee-joint, but occasionally in the thigh. After a few days this pain disappeared. He then noticed a similar pain in the left leg. Four weeks before admission he had an attack of sore throat and grippe, followed by a very high fever and pain all over his body. He lost weight and was very irritable.

Physical examination at the time of admission showed a poorly developed boy of about six years of age who did not appear acutely ill. There was no inequality of the pupils and they reacted normally to light and accommodation. The throat and pharynx were markedly injected and the glands in the superior triangle of the neck were slightly enlarged. On percussing the chest there was dulness in the upper portion in the midline (retrosternal dulness) which extended a few finger-breadths to either side of the sternum and down to about the

third rib. The heart was not displaced. There was decreased resonance over the upper right lobe posteriorly and a few crackling râles were heard over both apices. The spleen was not enlarged and the liver was palpable There was no glandular enlargement elsewhere in the body. There was no cyanosis and the veins of the head and neck were not distended. Temperature ranged from normal to 103° F. Pulse was rapid. The white count on admission was 25,000, with 80 per cent. polymorphonuclear leukocytes.

Radiograph of the chest showed a mediastinal mass of rather vague outline pushing the trachea slightly to the right. Radiographs taken at different angles showed this mass to lie in the anterior mediastinum.

I was called in consultation and found conditions as above mentioned. The differential diagnosis presented many difficult and interesting features. The temperature and leukocytosis pointed to an inflammatory condition, probably an abscess. The history of the sore throat and the presence of a red and injected pharynx and slightly enlarged glands in the upper portion of the neck, coupled with a mediastinal mass, strongly suggested an abscess of the upper mediastinum due, probably, to direct extension of the infection from the tonsils. Moreover, the lack of distention of the veins of the neck and the absence of respiratory disturbances favored a compressible mass rather than a firm, hard tumor mass. However, these findings of respiratory embarrassment and distention of the veins of the neck are often lacking, even in very large tumors of the mediastinum. The irregularity of the mass, on the contrary, suggested a mediastinal tumor other than of inflammatory origin.

Another condition which had to be thought of was an encapsulated empyema resulting from upper lobe infection, producing a picture simulating mediastinal tumor.

The radiographs were taken in the upright position in order to show the presence or absence of a fluid line. No fluid line was apparent.

The boy was kept under observation for several days, his condition remaining unchanged His temperature varied from

normal to 103° F. A few days later I was again asked to see him. I advised against exploratory puncture because of the danger of producing an infection of the lung or an empyema, should this be an abscess of the mediastinum. I recommended exploratory mediastinotomy.
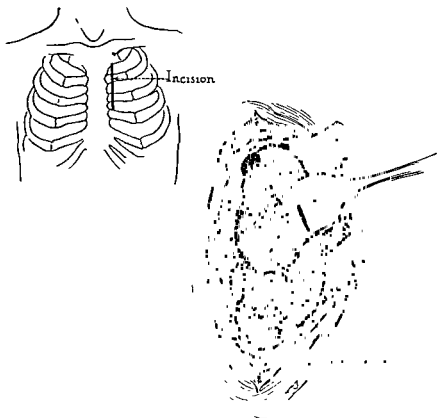
Fig. 398 —Diagram illustrating the incision and the approach to the anterior mediastinum. The second and third costocartilages have been cut and bent upward. The left parietal pleura has been stripped laterally and is being held out of the field by a retractor. The nodular tumor is seen in the depth.

A few days later under nitrous-oxid and oxygen anesthesia an incision was made to the left of the midsternum. The skin and fascia were cut through a little lateral to the costosternal junction. The ribs were then fractured 1½ inches still further laterally and the sternal ends turned upward. The pleura was displaced with remarkable ease, exposing the anterior mediastinum.

As the mediastinum was exposed a small tumor mass about the size of an olive appeared in the wound and on examination still other masses of a similar nature, red and apparently firm, came into view. By displacing the pleura lateralward and downward practically the entire anterior mediastinum was easily exposed. It was now distinctly seen that the mass was composed of many small, firm, nodular tumors. One of these was excised for microscopic examination It was evident that our diagnosis of a probable mediastinal abscess was wrong and that the case was one of mediastinal tumor. On exploration it was found that this mass not only involved the anterior mediastinum, but that small, hard, firm, masses seemed to penetrate down toward the hilus of the left lung For this reason it was deemed inadvisable to attempt a removal of the mass The wound was sutured in layers, the ribs being held in approximation by sewing them to the cartilaginous portion of the sternum with heavy chromic catgut.

The boy stood the operation very well and a few days after seemed better than he had been before operation. The laboratory returned a report of Hodgkin's disease, which surprised us very much.

After-course —Within a few weeks after operation the glands in the neck, which we had taken to be inflammatory glands following a tonsillar infection, rapidly became enlarged Shortly afterward the inguinal glands became enlarged This glandular enlargement occurred in spite of persistent *x*-ray treatment. The general condition of the child, however, markedly improved. His temperature became virtually normal. The *x*-ray treatments are being continued and we are in hopes that they may keep the disease in abeyance.

This case is presented because. aside from the interesting thoracic features which will be discussed later, it demonstrates that Hodgkin's disease can apparently start with an enlargement of the mediastinal glands

Case II.—The second case is a tumor of the posterior mediastinum. This patient, a man of forty, came into the hospital with the following complaints·

He stated that ten weeks previous to admission he took a pill which seemed to lodge above the stomach and could not be dislodged even with drinking seven or eight glasses of water. After a few hours the pill seemed to pass on but a steady burning sensation, as he described it, "in back of his heart," persisted, and any solid food which he took seemed to stick in this region before passing down into the stomach. Later he was unable to eat any solid food whatsoever unless he followed each mouthful with several mouthfuls of water. Finally, he avoided solid food and subsisted on a liquid diet. He lost 25 pounds in weight and was very weak, which he attributed to his inability to eat.

His temperature on admission was normal and blood examination showed no abnormality. Physical examination was irrelevant except for the presence of dulness in the lower right posterior portion of the chest. The interspaces were not bulging. There was perhaps a slight diminution in intensity of the breath sounds over the right chest. However, the lower lung borders moved freely on respiration and the breath sounds, although faint on the right side, were otherwise normal.

Radiographic examination showed a large tumor mass in the posterior mediastinum, pushing the heart forward. The tumor extended from about the fourth to the eighth thoracic vertebræ and was about two-thirds the size of the heart. The antero-posterior view showed a small bulging at the upper level of the heart shadow, but proved that the tumor was in the midline. The bismuth meal showed that the esophagus was obstructed by the tumor. The esophagus seemed to run over the tumor in such a way that it was compressed only on one side by the tumor, the esophagus being pushed to the right and toward the sternum. Esophagoscopy was not attempted nor was the passing of esophageal sounds, because it seemed apparent from the x-ray findings that the compression of the esophagus was due to lateral pressure.

Before coming to the hospital the patient had been under observation and treatment for a malignancy of the mediastinum, the diagnosis having been based upon the presence of a tumor shadow and the marked cachexia, but in spite of the x-ray

treatment the shadow gradually increased. It was therefore
decided to attempt removal of the tumor mass.

Under nitrous-oxid and oxygen anesthesia an incision was
made about 7 inches long, posterior to and to the right of the
spinal column, the sixth and seventh ribs being exposed. About
3 inches of the ribs were resected. By retracting the right
pleura, the posterior mediastinum was exposed from the fifth
to the eighth ribs, the right pleural space being unopened. The
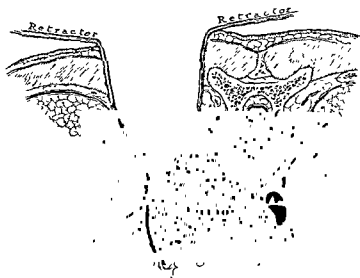
Fig 399 —Cross-section showing the approach to posterior mediastinum
The right parietal pleura has been stripped and it, the pleural space, and the
right lung are retracted laterally to disclose the tumor

tumor was identified as a round mass, the size of a large apple,
covered by a smooth layer of tissue The esophagus was seen
coursing alongside the tumor and apparently was not involved.
The heart was pushed forward. It was deemed inadvisable at
this time to attempt removal of the tumor, it being considered
safer to pack off, allow adhesions to form, and remove the tumor
at a second operation A large Mikulicz pad was placed in the
wound and held firmly by bandages. The patient was returned
to bed.

Subsequent Course.—As soon as the patient awakened from the anesthetic he asked for a drink of water and immediately said that his swallowing was easier than it had been at any time in the previous ten weeks. The next day he was given oatmeal, toast, and crackers and expressed his delight at being able to swallow these with apparent ease. There was a slight increase in temperature for three or four days after operation. On the ninth day, the day before we intended performing the second stage of the operation, the patient suddenly called for a pus basin, saying he was going to vomit. Before the nurse could get to him he emitted a tremendous quantity of bright red blood through his mouth, sank into collapse, and died immediately afterward.

The postmortem findings were exceedingly interesting. In the posterior mediastinum and seeming to extend from the outer margin of the esophagus there was a mass about the size of an apple, which had eroded into the descending aorta, producing an irregular opening about 1 cm. long. The lumen of the esophagus was constricted by the advancing tumor mass. There was a very slight ulceration of the esophagus. There was evidently a direct communication by means of the tumor substance with the aorta. The wall of the left bronchus near the bifurcation was markedly thinned by the advancing tumor mass which had invaded the substance. Beneath the parietal pericardium was a necrotic, foul-smelling mass which was in direct communication with the aforesaid tumor mass. There was a large amount of mucopurulent substance in the bronchi of both lungs and both lungs on section exuded a red frothy fluid. The upper bronchial glands were hard and firm. Except for a hard, firm lymph-gland beneath the diaphragm no other tumor masses were found. On microscopic examination it was shown that the tumor mass was composed of nests of coarse stratified squamous epithelium, the cells showing marked variation in size and much mitosis. The tumor cells were highly invasive and obviously malignant. Section of the esophagus showed that the tumor mass apparently originated from the esophagus and then grew into the posterior mediastinum.

The diagnosis made by our pathologist, Dr. O. T Schultz, was carcinoma of the esophagus.

Discussion.—These 2 cases emphasize most of the important practical points of tumors of the mediastinum. Although unusual, tumors of the mediastinum are not nearly as rare as we have been led to believe With more careful radiographic technic I am sure that larger numbers will continually be discovered.

The age incidence of tumors of the mediastinum is the same as that of neoplasms in other portions of the body. Embryologic tumors, dermoids, teratomata, and sarcomata become manifest in early life, whereas carcinomata and tumors due to vascular disease occur in later life

The diagnosis of tumors of the mediastinum is always difficult because it is rarely that the tumor can be directly palpated. The diagnosis must be made from deduction, inference, and the symptoms presented. They are, however, often symptomless. When symptoms are present they are almost invariably those of pressure However, because of the loose structure mediastinal tumors can reach a large size without exerting sufficient pressure to cause symptoms In our first patient it was the temperature which called our attention to the disease, and the finding of dulness on percussion and the localization of the tumor mass pointed to the anterior mediastinum Although the tumor was of large size no pressure symptoms such as a dilatation of the veins of the head and neck, or pupillary changes due to pressure on the sympathetics, or vocal changes due to pressure on the recurrent laryngeal nerve were noted In the second case the only pressure symptoms the man complained of were those due to compression of the esophagus

When such signs as engorgement of the veins of the head and neck, inequality of the pupils, difficulty in swallowing and breathing are present the diagnosis is greatly facilitated Tumors in the posterior and lower part of the mediastinum are apt to give pressure symptoms relative to the intake of food, but occasionally it is surprising to see how far the esophagus can be pushed out of its normal course by a tumor mass without producing symptoms.

In the second case the faintness of the breath sounds noted on the right side as compared to those on the left side probably were caused by pressure on the right main bronchus. The heart may be pushed to one side or the other or may remain in the midline, its position apparently unchanged, as in these 2 cases. If the tumor is large enough, compression of the lungs may be noted on physical examination, but, as a rule, this is not the case. Careful percussion will aid in establishing the presence of a tumor of the anterior mediastinum. Substernal dulness, as a rule, can be percussed. There is more often dulness than flatness because, as in the first case, the pleural sacs maintain their relative position and a thin layer of air-containing lung is often noticed between the tumor and the chest wall.

Radiographic examination is of tremendous value. Almost any tumor of the mediastinum is of sufficient density to show in the film provided it is taken in the correct position. If we rely simply on an anteroposterior view, many cases of mediastinal tumors will be overlooked. Great credit is due to Dr. Le Wald, of New York, for emphasizing the importance of the three-quarter view. Radiograms taken in this direction frequently disclose tumors or show the size and extent of the tumor when an antero-posterior view will apparently indicate no mediastinal abnormality. A lateral view will aid greatly in demonstrating a tumor, providing that the tumor mass is not so situated as to be excluded or as to be overshadowed by the spinal column. I make it a routine practice. in patients who are able to be up, to verify the radiograms by fluoroscopic examination. By slowly rotating the patient behind the fluoroscopic screen the chest can be viewed from all angles and in this way mediastinal tumors will very rarely be overlooked.

In the differential diagnosis between a solid tumor and a lung abscess it is very important to view the patient in the upright position because the establishment of a fluid level line is of such tremendous diagnostic value. The presence of air in the abscess cavity causes a "fluid level" to appear. It is advisable to give the patient an opaque meal because the contour and the position of the esophagus is of great importance in establishing the diagnosis.

Furthermore, an esophageal diverticulum may simulate a mediastinal tumor and the filling of the diverticulum with the bismuth meal will definitely prove its presence. The trachea usually is easily distinguishable in the film and its position will frequently give valuable evidence In the first case the trachea was pushed toward the right and seemed slightly constricted. Occasionally the trachea is so constricted by the tumor that it is no longer a round tube, but assumes the figure of a saber sheath. These cases, as a rule, show evidences of dyspnea.

Diagnostic puncture of mediastinal tumors is rarely of any value and usually very dangerous

Treatment of mediastinal tumors, like treatment of neoplasms elsewhere in the body, depends usually upon the character and the position of the neoplasm. Benign tumors may require no treatment whatsoever.

Some mediastinal tumors may be amenable to Roentgen therapy, while others may require excision No general rule can be laid down Each case must be studied for itself and treated accordingly

It is only lately that we realized that operations on the mediastinum are not only possible but in some cases comparatively easy, and that in a large number of cases the extremely unfavorable prognosis without operation justifies the operative risk.

A few points as regards the operation of mediastinal tumors may be of assistance· First, the tumor must be localized with the greatest accuracy because the operative procedure differs radically when different portions of the mediastinum are involved. In operating on the mediastinum I always use pressure-anesthesia. Although in normal individuals, the collapse of one lung may not have to be feared, yet in mediastinal tumors both sides must be opened so frequently that it is safest to have at hand some method of expanding the lungs. I use nitrous-oxid and oxygen anesthesia, preferably with the addition of ether if necessary. I employ no pressure appliances outside of the ordinary gas tanks and the usual face mask used for general gas inhalation anesthesia By increasing the flow of gas or by press-

ing on the outlet valve of the mask the anesthetist can so regulate the flow of gas that almost any desirable pressure can be obtained at a moment's notice. With this type of anesthetic I feel prepared for any emergency. I realize the value of local anesthesia and use it very extensively in other types of cases, but where I attack the mediastinum I prefer to have an anesthetic which will force air into the lungs should I by chance happen to open both sides of the thoracic cavity.

In a large number of mediastinal tumors it will be found that the operation can be carried out without entering either of the pleural sacs In the 2 cases presented the pleural sacs were not entered. In the first case it was possible to expose practically the entire anterior mediastinum by retracting the pleura after cutting through the second and third costal cartilages and retracting the ribs laterally. If more room is required the fourth costal cartilage can also be cut or the sternum can be sawed transversely and then the flap of sternum retracted toward the opposite side. It is also possible to gain access to the anterior mediastinum by slitting the sternum and then at the lowest point of the line of cleavage cutting across the sternum at both directions and thus retracting the sternum laterally to the right and to the left.

Incision for the posterior mediastinum is by preference just lateral to the spinal column, resecting the requisite number of ribs and then retracting the ribs laterally. Here again it is very easy to separate the pleural sac from the adjacent tissues and obtain excellent access to the posterior mediastinum without entering the pleural spaces. Where the tumor involves the pleura itself it may not be possible to retract the pleura but it may be necessary to cut directly through the pleura, opening up the pleural space in this case. As a rule, in this type of case the pleural space can be obliterated at the site of the tumor by packing, causing the two layers of the pleura to adhere.

Unless the tumor is easily enucleated I believe in the two stage operation. The resection of many ribs alone is accompanied by shock, although during the time of the operation the patient apparently seems to be withstanding well. We have

learned this through sad experience in our earliest thoracoplasties where patients who was apparently well withstanding the multiple rib resection went on later to collapse.

The time is not far distant when we will regard operative interference in the thorax with the same sense of assurance that we now feel toward abdominal operations. When that time comes we will place mediastinal tumors in the category of diseases amenable to surgical treatment

AN ANALYSIS OF THE RESULTS OBTAINED IN GASTRIC SURGERY

INSTEAD of attempting to demonstrate anything in the way of technic, I am going to discuss with you one of the most important questions in gastric surgery.

What does gastro-enterostomy do? A fair question and a pretty one. Since Doyen, in 1893, did the first gastro-enterostomy for ulcer, twelve years after Wölfler introduced the operation, this question has challenged alike the surgeon, the internist, and the physiologist. Today, gastro-enterostomy is one of the most definitely established operations in abdominal surgery. Nor is it likely to be immediately supplanted by the more radical operations advocated by some of the enthusiasts of the German School. In an editorial in the August 1924, issue of Surgery, Gynecology, and Obstetrics, W. J. Mayo[1] says that 94 per cent. of duodenal ulcers are cured by gastro-enterostomy. Sherren[2] reports 92.6 per cent. of patients well two or more years after operation. (He believes that recurrences do not take place in patients healed over two years.) Balfour,[3] at the meeting of the American Medical Association last year, reporting the end-results in 1000 patients operated upon ten or more years ago for duodenal ulcer, states that 84 per cent. have obtained "satisfactory results." Peck,[4] in reviewing 196 of his own cases, concludes that "a lasting clinical cure may be expected in at least 80 to 90 per cent. of cases treated by simple gastro-enterostomy." Horsley,[5] on the other hand, believes that less than 50 per cent. of gastro-enterostomies remain well. v. Haberer,[6] finds that gastro-enterostomy does not give satisfactory results and advocates more resections in duodenal ulcer. Finsterer's spec-

tacular operative tour of America is still too fresh in our minds to forget his extremely radical resections done because of his avowed disbelief in the efficacy of gastro-enterostomy.

For *gastric ulcer* gastro-enterostomy alone meets with even less approval by most medical men, although still the operation preferred by Burk.[7] Sippy, whose medical management of peptic ulcer gained for him a world-wide reputation (and whose untimely death we all greatly mourn), for a long time advised against gastro-enterostomy in gastric ulcer. Uduonda[8] reports but 27.24 per cent. of his gastric ulcer patients free from distress one to four years after gastro-enterostomy. I might quote innumerable others with almost as discouraging results.

That gastro-enterostomy cures a much smaller percentage of gastric ulcers than it does of duodenal ulcers, is, I believe, the generally accepted position of American surgeons. Resection of the ulcer is unquestionably more logical and gives much better promise of permanent relief and a satisfactory result

Recent literature contains a number of arraignments of the time-honored operation of gastro-enterostomy. The disappointing results of gastro-enterostomy led Eiselsberg and Doyen to adopt the pyloric occlusion operations which v. Haberer condemns on the ground that gastrojejunal ulcer follows in 15 per cent. of cases. He advocates partial resection and reports a mortality of only 5 per cent in some 2000 cases. Clendenning[9] analyzed 36 cases of gastro-enterostomy in which 14 had subsequent difficulties. In spite of this high percentage of unfavorable symptoms, he believes gastro-enterostomy to be the operation of choice and thinks that most of the postoperative *troubles are to be explained as errors in technic, judgment, or diagnosis*

The current literature contains so much in defense of and against gastro-enterostomy that one is forced to wonder why this great divergence of opinion. What does gastro-enterostomy do? What are its shortcomings? Why should there be failures?

In an attempt to answer some of these questions, I have reviewed the histories of the last 500 patients discharged from the Presbyterian Hospital with the diagnosis of peptic ulcer.

Of this number 75 were diagnosed as gastric and 425 as duodenal. Nineteen of these patients entered the hospital on account of unsatisfactory results *after gastro-enterostomy.* They reveal some interesting data. (See Fig. 400.) They vary in age from twenty-nine to fifty, the majority being under thirty-five. The onset of symptoms beore operation varied from a few months to twenty-nine years, the average being nine years for those who gave a definite period of time, and two-thirds being of seven or more years' standing. I was somewhat surprised to see how young most of the patients were when their first symptoms occurred, 5

DURATIONS OF SYMPTOMS

Case No.	I	II	III	IV	V	VI	VII	VIII	IX	X
Hospital No.	136547	162450	143376	161563	156104	128100	164697	157172	177683	134040
Age at Op.	24	43	50	31	31	33	43	40	17	36
First Symptom Appeared at	23	Many Years	To of Years	16	16	23	35	32	17	34
Duration	1	?	?	15	15	10	8	8	Few Months	2
Relief for	7¼	1	5	3 Mos.	13	4	2	6 Mos	3	0

Case No.	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	Average
Hospital No.	160468	147755	153101	142426	130903	176622	139932	215863	150085	
Age at Op.	43	42	50	42	26	33	33	23	26	35
First Symptom Appeared at	14	15	42	35	24	25	23	22	23	25
Duration	29	26	8	7	2	8	10	1	3	9
Relief for	0	3	6 Mos.	8 Mos.	5 Mos.	6 Mos	3	6 Mos	2	2 6

Fig 400.

dating the onset at fifteen to seventeen years, and in 11 the trouble appeared before the age of twenty-five. The most frequent cause for return was hemorrhage (eight cases). The return of symptoms occurred as early as three months after operation and as late as eleven years. Eight of the patients were re-operated, resection of the pylorus and the ulcer being done in most cases. Nor does this cure all recurrences.

This man (Case VIII, see Fig. 401) is a good example of what some patients can endure. I first saw him in 1922. The diagnosis of duodenal ulcer had previously been made in an-

other hospital and the patient had been on accurate ulcer management for four weeks. He could not, or would not, follow management after leaving the hospital, and came to me ten months later with obstruction. His test-meal before operation showed a total acidity of 93, free HCl 20. June 22, 1922 a gastroenterostomy was done by Dr A D Bevan A duodenal ulcer
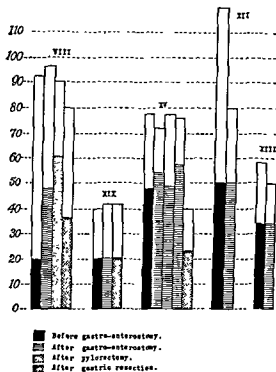
Fig 401—Shadow area represents free HCl Entire column indicates
total acidity.

of good size was found, but was not touched For six months the patient was free from symptoms, but he returned in May, 1923, with typical ulcer distress. His Ewald at that time showed a total acidity of 96; free HCl 48. His motor meal had passed in seven and one-half hours Fluoroscopic examination revealed the same duodenal defect seen before operation, little was passing through the pylorus, and the gastro-enterostomy was function-

ing (Fig. 402, A). Therefore, I concluded that the duodenal ulcer had not healed, and on May 23, 1923 I resected the pylorus and the portion of the duodenum bearing the ulcer. No jejunal ulcer was found, although there were many adhesions about the stoma. Shortly after this operation, the patient began to complain of definite distress of a new type and in November, 1923 a
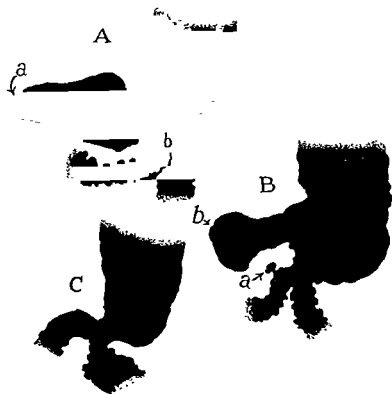
Fig. 402.—Case VIII. A, Showing little barium passing through pylorus (a), no cap to be seen; b, gastro-enterostomy stoma. B, Penetrating ulcer (a) in jejunum after gastro-enterostomy and pylorectomy. b, shows pyloric end of stomach cut off a short distance proximal to pyloric ring C, Cardia after resection of jejunal ulcer and most of fundus. Polya closure

penetrating jejunal ulcer was found by x-ray (Fig 402, B, a). On July 18, 1924 a jejunal ulcer 2 cm. beyond the stoma was found and removed. The entire pyloric end of the stomach was removed and a Polya closure made (Fig 402, C). He has been free from ulcer symptoms since. Finsterer maintains that in doing this he has removed the acid-secreting portion of the mucosa. That this was not done is shown by the Ewald of

August 8, 1924, total 80, free HCl 35. x-Ray shows a very rapid emptying of stomach and a motor meal passes in much less than normal time. Case XIII had almost the same experience. Note her acidity two months after resection of a large portion of the stomach is total 40, free HCl 22.

Case XV (Fig 401) had a total acidity of 40 and a free HCl of 25 after resection of the pyloric half of her stomach. These findings do not agree with those of surgeons who maintain that resection of the fundus eliminates the likelihood of recurrence by removal of the acid-producing part of the stomach.

A study of microscopic anatomy shows that this is not the case, although such resections may remove the ulcer-bearing part of the stomach (the Magenstrasse). It is true, however, that when a wide stoma has been made as in the Polya operation, especially after big resections, anacidity frequently follows. In some instances, this may be permanent, owing to the regurgitation of duodenal contents through the large opening, and also the very rapid emptying of the stomach. Theoretically, such resections would seem to be ideal provided the mortality can be reduced to that of the more simple operations. I have seen a number of these patients, however, who complained constantly of discomfort and bowel distress, sometimes accompanied by diarrhea

Sir Berkeley Moynihan has classified his Disappointments after Gastro-enterostomy as due to the following causes·

1. *Unnecessary Operation.*—There is no case in this series falling definitely into this class, although everyone who has had much gastric surgery experience has seen numbers of patients who never should have had a gastro-enterostomy Undoing their gastro-enterostomies and correcting the original pathology has relieved them permanently of their symptoms. I believe we are doing very few unnecessary operations today, as few surgeons will now do a gastro-enterostomy in the absence of definite tangible pathology.

2. *Incomplete Operations* —Many surgeons excise the ulcer in addition to gastro-enterostomy Moynihan infolds his ulcers and covers them with omentum, believing this safer than ex-

cision. In most cases of gastric ulcer I feel that resection of the ulcer is indicated rather than gastro-enterostomy, although, in selected cases, it should be combined with gastro-enterostomy.

3. *Defects in technic*, such as too long a loop, kinking of the jejunum, adhesions, too small an opening (he makes his openings $2\frac{1}{2}$ inches long), badly placed opening, hernia through the transverse mesocolon, use of non-absorbable suture, or ventral hernia. I might call attention, in passing, to the fact that 3 of our patients in this series stated they were operated upon by that master of technic, Dr. W. J. Mayo, one other at the Mayo Clinic, three by Bevan, two by Phemister, one by Erdmann of New York, one by Dean Lewis, one by Halstead, and most of the others by surgeons of recognized ability, thereby minimizing the likelihood of the above errors in technic creeping in.

4. *Late complications*, such as jejunal ulcer, or carcinoma developing in a chronic ulcer. While but three definitely proved jejunal ulcers were found in this series, a number of the unoperated patients may have bled from a marginal ulcer rather than from the site of the old ulcer. This complication seems to occur in at least 2 per cent. of cases, regardless of operator, technic, or suture material. This man (Case VIII) developed his ulcer about an inch from the site of the anastomosis, and microscopic sections fail to reveal any evidence of linen in the ulcer. Sections of the margin of the stoma show linen still embedded in the tissues with practically no reaction about it. Montgomery has demonstrated in dogs that by accurate approximation of each layer of the gastric and jejunal walls the likelihood of development of subsequent ulcer was greatly reduced. In our clinic we have remained loyal to the old Billroth three-row suture method, which produces accurate approximation of the mucosa, reduces the likelihood of hematoma, and entirely eliminates postoperative hemorrhage from the newly made stoma.

While I can find numerous other recurrences in our records, this series is large enough to show that gastro-enterostomy does *not* cure all ulcers, and that postoperative complications occur in the hands of the most skilled operators.

This series also shows what is now pretty generally recognized, that is, gastro-enterostomy does *not* shorten the emptying time to less than normal and some of our patients still showed some retention (Cases VIII and XVII). *Gastro-enterostomy does not drain*

While Paterson has maintained that gastro-enterostomy produces healing by lowering the stomach acidity one-third, the findings in some of these patients would seem to indicate that *hyperacidity is not prevented by regurgitation of bile and duodenal contents into the stomach* (Cases VIII and XV). The lowered acidity which has been observed to occur after gastro-enterostomy is probably secondary to the healing of the ulcer rather than the result of the operation. Smithies[11] examined 262 patients after gastro-enterostomy and found an increased acidity in 5 per cent and no reduction in 14 per cent The reduction occurring in the remaining cases was decreasingly less as the time after operation increased It is a well-established fact that unhealed ulcers are occasionally found in patients with *no free HCl acid*, so that the reduction of acidity cannot be the only factor necessary to healing Reference to the physiology of gastric digestion will recall to your minds that while there is an optimum strength of HCl, digestion takes place to almost the same extent whether this acidity be raised or lowered within the limits which can be obtained in the body.

What then does gastro-enterostomy do? What can we expect to gain by the operation?

In the first place, it reduces the emptying time to normal or nearly normal time. It thereby relieves obstructive symptoms, such as nausea, vomiting, and visible peristalsis There is nothing more satisfactory in surgical therapy than the gratifying results seen in the relief of high-grade pyloric obstruction

Second, according to the best authorities, in somewhere between 85 and 94 per cent. of patients suffering from duodenal ulcer, it relieves the pain. While relief of pain does not prove that the ulcer is well healed, the annoying clinical symptoms are of prime importance to the patient, and he is usually satisfied with the result unless he has some other complication

In the third place, it does materially aid in the healing of a duodenal ulcer by placing it in the position of a lesser curvature ulcer, that is, it removes the element of obstruction, prevents the action of continued (or overnight) secretion and lessens the hypermotility. It may reduce gastric acidity, although as I have already mentioned, I believe that this is incidental and rather the effect of healing.

Fourth, gastro-enterostomy reduces intragastric tension. This, I believe, is a very important element in healing and one to which little heed has been paid. In attempting to demonstrate graphically just what occurs, Dr. Atkinson and I have taken a thin rubber balloon, attached it to a Rehfuss tube, and recorded the contractions of the stomach upon a slowly moving kimograph. While we have only enough records to be suggestive, it seems that the intragastric tension is materially lowered in cases of gastro-enterostomy which are working properly. We found in one case that the intragastric tension was increased after operation. Coincidently, however, we found that the patient's peristaltic waves as seen in the fluoroscope were much more active and nothing seemed to pass through the gastro-enterostomy stoma. In order to make these experiments of definite value it is going to be necessary to follow up a considerable number of cases and, as some patients will not cooperate in this experimental work, it will require sometime before we can arrive at definite conclusions. I simply present these suggestions. As Moynihan[13] has well said, "Clinical research is of all inquiries the most difficult in medicine, making the heaviest demands upon the knowledge, the powers of observation, the imagination, and the intellectual integrity of those who engage in it."

Most surgeons will tell you that duodenal ulcer is much more frequent than gastric. Eusterman[12] says that 70 per cent. of the peptic ulcers at the Mayo Clinic are duodenal and that more than half of the gastric ulcers are at or near the pylorus. The pathologists, on the other hand, find gastric ulcer is much more frequent than duodenal. This difference of opinion is readily explained by the fact that a great many gastric ulcers heal on

very mediocre management, or on no treatment at all   They
leave a thin scar which can only be found by careful postmortem
examination. They cannot be demonstrated by x-ray or felt at
operation. The ulcer subjected to continual hyperperistalsis is
apt to become chronic and it is this type which comes to the
clinician or the surgeon   By reducing the *intragastric tension*
the duodenal ulcer is placed in a situation similar to that of a
gastric ulcer   In other words it is placed in a condition favor-
able to healing   The gastric contents are no longer forced
directly against the duodenal raw spot by a hypertrophied
musculature attempting to overcome a pylorospasm or an actual
stricture. Bircher, in an address at the Fifth Swiss Surgical
Congress, said that ulcer seems to be the outcome of a vagotonic
circle formed by hypersecretion, retarded evacuation, and pyloro-
spasm   Gastro enterostomy breaks up this vicious circle, per-
haps by altering the gastric secretion, but probably by changing
the intragastric tension

Fifth, gastro-enterostomy insures against perforation   Care-
ful survey of our records fails to show any case of perforation
following gastro-enterostomy   This is especially true of duo-
denal ulcer where perforation is apt to occur at the height of
digestion when the gastric waves of an hypertrophied stomach
wall are forcing the stomach contents against a diseased and
friable duodenum   Although this assurance is not absolute, and
occasionally a perforation is reported subsequent to gastro-
enterostomy, these cases must be very rare, and probably most
of them occur at the site of a jejunal ulcer.

Sixth, properly performed gastro-enterostomy remains patent
permanently and acts as a safety-valve   This probably explains
why so many patients have permanent relief. When the duo-
denal ulcer has healed, most of the stomach contents again
pass out through the pylorus unless there is very marked
cicatricial contracture   At the first evidence of return of trouble,
the pylorus becomes spastic and the gastro-enterostomy resumes
its function

My conception of a stomach or duodenal ulcer is that its
pathology resembles that of the familiar varicose ulcer of the

leg. "Mrs. McGinty has had ulcers on her leg for these twenty years and no doctor could heal them at all. She's tried dozens of 'em and spent many a dollar on all-colored salves. But she had the pneumonia, she did, and we thot Mrs. McGinty would die, but when she got out of bed, do you know, her legs was well, and no doctor looking at 'em at all." If we give a patient with varicose ulcers rest, and keep her feet elevated, healing usually occurs within a short time, but if irritation be continued all medication is apt to be futile.

In conclusion, I may say that I have not attempted a vindication of gastro-enterostomy, but have made what I hope is an honest effort to ascertain the facts about it, "Nothing extenuated wherein it is worthy, nor aught set down in malice." More than twenty years ago Moynihan made the statement that gastro-enterostomy was but an incidental aid in the management of ulcer. The farsightedness of this capable, charming Irishman of Leeds is evidenced by the agreement of this statement with our notions today. Gastro-enterostomy will do certain definite things It works *no* miracles It produces healing in a large percentage of duodenal ulcer and in some gastric ulcers. I feel very strongly that it is an operation which should not be abandoned like last summer's bonnet for more radical operations entailing a higher mortality simply because they are newer. There must be more definite indications than that.

Finally, let me repeat once more what I have said so often before, that is, I believe that any operation for ulcer should be followed by a course of careful therapeutic and dietetic management.

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CLINIC OF DR. EDMUND ANDREWS

St. Luke's Hospital

A SIMPLIFIED HERNIOTOMY

THE patient is a young man, twenty-four years old, who developed a hernia within the last month. His father and one brother also have had inguinal hernias. He suddenly felt a peculiar sensation in his groin one day when he was skating and noticed a small lump there. Within ten days, when he consulted me, it had descended in the canal so that when he coughed it just emerged from the external ring. The external ring is intact, that is, it is small, not admitting the finger tip and the external oblique aponeurosis has not been stretched by any long-standing pressure from within.

I would like to say a few words here about the current misconception about the relation of enlarged external rings to hernia. They are a result and not a cause of hernia. The mere fact that a man has external rings a little larger than normal should not be considered evidence that he is likely to develop a rupture. A hernia occurs for two reasons: First, because there is a preformed sac, the remnant of the tunica vaginalis, and, second, because the internal ring (the hole in the abdominal fascia) is too large. The condition of the external oblique aponeurosis has nothing whatever to do with the case. This is not only a theoretical point, but can easily be checked by careful observation. I have checked on a very large number of cases in which herniation had very recently occurred, and found the external rings to average about the same as in the normal. Enlargement takes place only after the hernia has pushed its way through into the scrotum and stretched the ring.

With such a small and recently acquired hernia it is often possible to bring about a radical cure without going through all the routine steps of a standard herniotomy. I think that a great deal of harm has been done by the persistent search for the ideal herniotomy. It is absurd to assume that there is such a thing, and simply reflects a laziness on the part of the surgeon Hernia is a multiform disease and the merest tyro can see that no two hernias are alike Herniotomy is a plastic operation. It demands on the part of the surgeon not only a certain amount of imitative ability but also the use of a little intelligence to plan a proper procedure to suit each case For this reason we must abandon any idea that we will ever find any one operation which will be applicable to every type of hernia. This is already well recognized in the case of the direct hernias, but we must go farther and plan suitable procedures for the many degrees and types of oblique hernias Therefore, in this case I am going to use a much simplified technic

After infiltrating the skin and subcutaneous fascia, I am making an incision about 1½ inches long over the internal ring. The needle is then inserted through the external oblique aponeurosis at the upper end of the incision and a large amount of anesthetic infiltrated about the nerves just above and lateral to the incision This infiltration, if carried out carefully and extended to each layer, will produce a satisfactory block of the field except for the peritoneum I prefer to attempt the blocking at this stage as it can be done through the skin before the operation is begun, as in my experience these blocks are rarely so successful that the skin infiltration can be done away with

The aponeurosis is now split in the direction of its fibers for 1½ inches and retracted. At the lateral end of the incision are exposed the origin of the lowest fibers of the external oblique and their arching course around the internal ring The cremaster is then lifted, incised, and retracted, exposing the elements of the cord. The sac is now seen It is easily identified at this level and I am beginning to free it about its neck In this case we can see at once that the neck is quite wide and funnel-shaped. Therefore I am going to open it at once You

see that I make no effort to remove this sac.   The edges are re-
tracted and the hole into the peritoneal cavity is closed by a
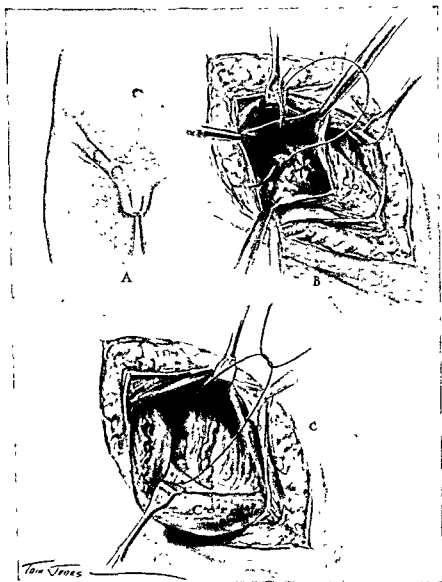

Fig 403.—A, Showing small incision over internal ring. B, upper end
of canal laid open, sac opened, and hole in peritoneum closed by running
suture. C, cord retracted downward   Single stitch being inserted between
edges of internal ring and Poupart's ligament.

running suture of catgut. This saves considerable dissection and
trauma caused by a sac removal and in my opinion is exactly

With such a small and recently acquired hernia it is often possible to bring about a radical cure without going through all the routine steps of a standard herniotomy. I think that a great deal of harm has been done by the persistent search for the ideal herniotomy It is absurd to assume that there is such a thing, and simply reflects a laziness on the part of the surgeon Hernia is a multiform disease and the merest tyro can see that no two hernias are alike Herniotomy is a plastic operation It demands on the part of the surgeon not only a certain amount of imitative ability but also the use of a little intelligence to plan a proper procedure to suit each case. For this reason we must abandon any idea that we will ever find any one operation which will be applicable to every type of hernia. This is already well recognized in the case of the direct hernia, but we must go farther and plan suitable procedures for the many degrees and types of oblique hernias Therefore, in this case I am going to use a much simplified technic.

After infiltrating the skin and subcutaneous fascia, I am making an incision about 1½ inches long over the internal ring. The needle is then inserted through the external oblique aponeurosis at the upper end of the incision and a large amount of anesthetic infiltrated about the nerves just above and lateral to the incision. This infiltration, if carried out carefully and extended to each layer, will produce a satisfactory block of the field except for the peritoneum. I prefer to attempt the blocking at this stage as it can be done through the skin before the operation is begun, as in my experience these blocks are rarely so successful that the skin infiltration can be done away with

The aponeurosis is now split in the direction of its fibers for 1½ inches and retracted At the lateral end of the incision are exposed the origin of the lowest fibers of the external oblique and their arching course around the internal ring The cremaster is then lifted, incised, and retracted, exposing the elements of the cord The sac is now seen It is easily identified at this level and I am beginning to free it about its neck. In this case we can see at once that the neck is quite wide and funnel-shaped Therefore I am going to open it at once You

hernias are direct ones just above the pubic spine. There was no hernia in this location before the operation and the only possible inference to be drawn is that it has been actually caused by our operation. We have operated in a normal portion of the canal and by injudicious stitching so weakened it as to permit herniation. This is truly a sad commentary on the efficiency of our surgical methods. In this operation the external ring is left intact, as is the normal part of the deeper tissues. It is only the actual seat of the disease which is attacked, the internal ring.

I have used this type of operation in an increasing number of cases. At first I was tempted to its use by the paper of Hull in which he reported 500 cases done without opening the whole canal. He, however, removed the sac, and did what might be described as the upper half of a Bassini operation. It makes an ideal procedure for the so-called "phantom operations," that is, where we operate on the apparently well side as an insurance at the same time as we cure the real hernia on the other side. When done in young individuals with oblique hernias, one rarely fails to find a sac on the "well" side. In many children and young adults with a very recently acquired hernia this minor procedure is ample to bring about a cure. The convalescence is generally almost painless. The patient can be allowed to sit up in bed the next day and can be sent home in a week, although no hard work should be done for a month.

I find that about 20 per cent. of cases are suitable for this type of surgery and the number should be far larger. If the laity as well as the profession could be educated to realize that a hernia should be operated upon as soon as it appears, a far larger percentage could be cured by a minor operation. This is especially true in children. Neglect means that the tissues are being stretched and torn, the hole is growing larger daily, and the radical cure is not only made more painful and dangerous but decidedly more uncertain. The popular fallacy that a truss will prevent the growth of a hernia is partly responsible for these delays. Any person who has had the slightest experience with trusses will realize that they do not prevent the growth of a

hernia. Of 18 cases of enormous hernias too large to be operable, which were recently examined, 13 had worn trusses for more than twenty years

If all hernias came to the hands of the surgeon in an early stage, our results would be far better and we could cure a majority with some such simple procedure as this

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SPASTIC PARALYSIS OF INFANCY AND CHILDHOOD: INCLUDING A PRELIMINARY REPORT ON THE SIXTEEN CASES OPERATED UPON IN CHICAGO BY DR. N. D. ROYLE OF SYDNEY, AUSTRALIA

Definition.—Spastic paralysis of infancy and childhood is a condition affecting the upper motor neuron and due to disease or injury of the cerebral motor centers controlling the extremities.

Nomenclature.—Spastic paralysis of infancy is usually called Little's disease because of the excellent monograph by this author in 1843. Reil, however, published an article on this subject as early as 1812. The condition is often called infantile cerebral spastic paralysis. If one extremity is involved, the term monoplegia is used; if half of the body, hemiplegia; if both lower extremities, paraplegia; if both arms and legs, diplegia or quadriplegia. The two latter types are usually congenital; the hemiplegic type often occurs during the first few years of life and in those cases usually follows disease.

Etiology.—Spastic paralysis is either congenital or acquired.

Congenital.—The causes of congenital spastic paralysis are cerebral defects such as defective development of the brain or pyramidal tracts, intra-uterine brain softening, porencephaly, cysts, or hemorrhage. Syphilis and injury to the pregnant mother are causes of less frequent occurrence.

Acquired.—The acquired causes are those occurring during labor and those occurring during childhood. During labor, trauma usually causes meningeal rather than intracerebral hemorrhage. Many cases are due to too violent treatment of asphyxia neonatorum. About two-thirds of the acquired cases

occur during the first three years of life. During childhood the
causes of paralysis are circulatory and those due to disease. The
diseases which are especially important are meningitis, cerebral
poliomyelitis, encephalitis, scarlet fever, whooping-cough, and
diphtheria, of which latter cause I have recently seen two cases.
The circulatory changes are hemorrhage, embolism and throm-
bosis.

Pathology.—The *essential* pathology consists of a lesion of
the motor area of the brain with descending degeneration of the
pyramidal and lateral columns of the cord. The local cir-
culatory changes are in the nature of arteritis, periarteritis,
endarteritis, and venous thrombosis. There may be encephalitis,
chronic meningitis, and possibly a sympathetic ramitis. The
cause of the spastic paralysis produces a lesion in the upper
motor neuron It is a hypertonicity rather than a paralysis.

The *associated* pathology consists firstly of the mental re-
tardation which is practically always present to a variable de-
gree, from almost normal to idiocy, and secondly of the deform-
ities with changes in the bones, joints, muscles, tendons, ligaments
and capsules of joints. The function of the heat-regulating center
may be disturbed.

Symptoms.—The symptoms of spastic paralysis are especially
those of the motor and locomotor apparatus.

The *motor* symptoms consist chiefly of the hypertonicity of
the skeletal muscles rather than a paralysis. There is a "twist"
in the innervation of these muscles. An excess of stimuli is
present and there is poor co-ordination. Sherrington's prin-
ciple of reciprocal innervation is disturbed in that when a flexor
muscle attempts to contract the opposing extensor muscle does
not relax as it should normally.

The *locomotor* symptoms consist of disturbances of gait.
These are due to two factors, viz., disturbed innervation and
deformities. The latter are due to changes in the muscles,
tendons, fasciæ, ligaments, bones, joints, and capsules of the
joints. The most common deformities are as follows: in the
foot, an equinus more commonly with varus; at the knee, flexion
with valgus; at the hip, flexion, adduction, and inward rotation.

In the upper extremity there is usually flexion of the fingers with flexion and adduction of the thumb; palmar flexion at the wrist; pronation of the forearm; flexion at the elbow, and flexion, adduction, and inward rotation at the shoulder (Fig. 405). In cases of marked deformity due to adductor muscle spasm there is produced a condition of cross-legs with its "scissors gait" (Fig. 404).
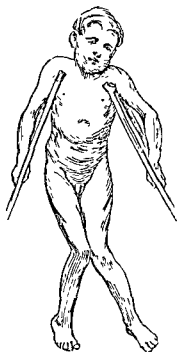
Fig. 404.—Illustrating attitude in spastic paraplegia, flexion adduction and inward rotation of thigh, flexion of knees, equinus of feet. Cross-legged attitude responsible for scissors gait.

Fig. 405.—Right hemiplegia, showing typical deformity.

Neurologic symptoms are ankle clonus, increased tendon reflexes, *i. e.,* heel, patella, triceps, pronator, radial, etc. Babinski, Oppenheim, and Gordon reactions are usually easily elicited. Facial paralysis may occur and trophic disturbances, ataxia, tremor, and athetosis are often found.

Fig 406 —Abduction cast consisting of two full leg and foot casts with crossbar maintaining abduction without the use of a double spica Patient sitting Following Stoffel obturator neurectomy and adductor tenotomy

The accompanying outline will serve as a guide in the routine examination of spastic paralytics

Case No

SPASTIC PARALYSIS CARD

Name   Age   Address   Phone No
Referred by   Address   Phone No
Complaint?
Duration?
Cause?
Obstetric history?
Mentality?   Intelligence coefficient?
Can patient walk?   Without aid   With aid of
Previous treatment?   Physiotherapy   Neuromuscular training
                       Massage   Electricity
                       Psychotherapy   Operation

Progress?   .

EXAMINATION

General impression
What is the mental background?   Intelligence?   Emotions?
Patient walking: Aid necessary
            Type of walk   Atonic   Hypertonic
            Balance—ataxia?
            Are there any mechanical obstructions, *i. e.*, contractures
               or deformities?
            Can he walk backward?   Sideways?   Hop?

Lying supine: Tropic disturbance.
            Can patient place extremities where directed?   Do they remain there?
            Can the examiner place extremities in various positions?   Do they
               remain there? *i. e.*, lengthening and shortening reactions.
            Is the patient's difficulty
               In changing his position?   In maintaining his position?
            Are his reflex movements under control?   Is reflex activity increased
               or depressed?
            Can he inhibit his movements?
            Presence or absence of cortical control of group movements.
            Contractures?   Do they prevent full range of movement and to what
               extent?
            Upper extremity.
            Lower extremity.
            Knee-jerk
            Is it present?
            Ease of elicitation.   Ease of relaxation
            Amplitude of movement.
            Time ratio of leg extension and fall?
            Step-ladder rise?
            When quadriceps is stimulated do hamstrings relax or contract?
            Does he possess reciprocal innervation?
            Relative amount of plastic tone?
            Relative amount of contractile tone?
            Are there superimposed corticospinal movements?   Tremor?
            Athetosis?   Influence of voluntary motion $\begin{cases} \text{Affected side} \\ \text{Non affected side} \end{cases}$
            Condition of spinal reflexes?
            Babinski.   Oppenheim   Gordon.
            Ankle clonus.   Patellar tendon clonus
            Does the patient exhibit phenomena more like the decerebrate animal
               or the spinal animal?
            Arm reflexes?
            Excess of associated movements?
Sitting position:
            Knee-jerks.
            Arm examination

Myotomy and immobilization is not practised extensively. Muscle and tendon transplantation help to balance a joint. Joint capsules and fasciae may be very important resistive factors in the correction of deformity. The former are amenable to capsulorrhaphy, the latter to fasciotomy.

Bones.—Operations on bones and joints are of value chiefly in cases of genu valgum and pronation of the forearm. An osteotomy of the radius or ulna can be done by drilling two holes perpendicular to each other, connecting one pair of holes by a small osteotome and twisting to correct the deformity (Royle). Occasionally an arthrodesis of a wrist is indicated

Operations on the Brain and Skull.—Cerebral decompression is of value in relieving pressure only. Operative removal of cysts or brain tumors are occasionally indicated but are practically of little value

Operations on Nerves.—*Alcoholization*—By injecting a peripheral nerve with 60 per cent alcohol it is rendered functionless for three to four months, during which time correction of deformities is attempted and relief of some spasticity may be obtained.

Foerster Operation.—In 1907 Foerster proposed intraspinal section of the posterior nerve roots dorsal to their ganglia. In this operation known as rhizotomy, the dura is exposed by a preliminary laminectomy, the posterior nerve roots are identified and the third, fourth, and fifth lumbar roots and the first and perhaps the second sacral roots are divided Recently Foerster advocated sparing the four lower cervical roots and the first dorsal. This is a severe, very difficult, and *highly technical* operation

Stoffel Operation.—This operation was proposed in 1911. It consists in partially cutting the peripheral nerves to the affected muscles. The object is to diminish the innervation of the spastic muscles. It is a quantitative measure and is based on the fact that every peripheral nerve has a certain definite internal topography or pattern, *i. e.*, certain bundles of fibers innervating individual muscles have a definite anatomic position in the nerve (Fig. 407). The technic varies somewhat with the area
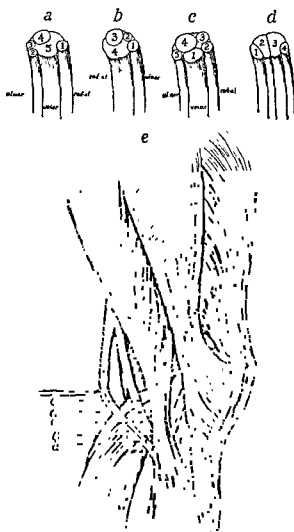
Fig 407.—Topography of peripheral nerves (Vulpius and Stoffel): a, Median nerve bundles for muscle groups: 1, Pronator radii teres, flexor carpi radialis, and palmaris longus; 2 and 3, for flexor digitorum sublimis; 4, for the flexor digitorum profundus, flexor pollicis longus; 5, for muscles of thenar eminence and one lumbrical. b, Ulnar: 1, For flexor carpi ulnaris; 2, flexor digitorum profundus; 3, for muscles of hypothenar eminence, interossei, third and fourth lumbricales; adductor pollicis and deep head of the flexor pollicis brevis; 4, sensory c, Radial 1, Sensory; 2, for brachioradialis; 3, for extensor carpi radialis longus and brevis. 4, extensor digitorum communis; extensor minimi digiti, extensor carpi ulnaris, abductor pollicis longus, extensor pollicis and extensor indicis proprius, 5, for supinator d, Peroneus communis; 1, peroneus longus and brevis. 2, for N N peronei profundus and superficialis, 3, for extensors digitorum longus and brevis, 4, to anterior tibial. e, Peroneus communis: a, Sensory; b, for peronei muscles. c, for tibialis anticus; d, for tibialis anticus and extensor digitorum longus. e, for extensors hallucis longus and brevis

involved. It may be combined with other procedures such as tenotomy, osteotomy, etc. To those who are interested, reference is made to the articles by Stoffel, Gill, Dickson, Heyman, Blahd, and Stern.

Royle Operation.—Sympathetic ramisection.

In January, 1924 there appeared two articles in the Medical Journal of Australia; one by N. D Royle, the other by J. I Hunter; the former an orthopedic surgeon, the latter an anatomist and neurologist. They revived the theory of the dual innervation of skeletal muscle and advocated the operations of cervical and lumbar sympathetic ramisection. With the belief that the increased "plastic tone" manifested by spastic muscles is due to impulses transmitted through the sympathetic rami, Royle cuts or avulses these structures

Cervical sympathetic ramisection consists of destruction of the pathways between the sympathetic cord and the nerves of the brachial plexus In the lumbar region the rami opposite the second, third, and fourth sympathetic segments are cut or avulsed and the sympathetic cord is severed below the fourth lumbar ganglion. The operation should be complemented by neuromuscular education and re-education, and in cases where contractures are present, by muscle, tendon, or bone surgery

The technic and rationale of the operation are found in Surgery, Gynecology, and Obstetrics, for December, 1924. A report of 16 cases operated by Royle will be found at the end of this clinic.

Kanavel, Pollock, and Davis have been unable to confirm Royle and Hunter's work either experimentally or clinically. Their work is reported in the Journal of Neurology and Psychiatry for February, 1925.

From a sociologic point of view it is questionable whether in the majority of cases it is not unwise to increase the "cruising radius" of spastic paralytics.

THE ROYLE OPERATION FOR SPASTIC PARALYSIS

PRELIMINARY REPORT OF 16 CASES OPERATED UPON BY DR. ROYLE
IN CHICAGO

THIS is a preliminary report of the result of operation on the 16 cases operated upon by Dr. N. D. Royle of Sydney, Australia, during October and November, 1924. They were operated upon at six hospitals.

Dr. Royle has stated that the cases in Chicago were not the best cases for demonstration purposes, but that every case operated offered considerable hope of improvement. There were many patients examined for whom operation was indicated, and these cases would have been much more desirable for demonstration of early results. Many of the parents of these cases would not permit operation. He has not, however, had as favorable a selection in Australia. At the six hospitals where cases were seen, about 160 in all, he recommended sympathetic ramisection in about 33 per cent. Ten of the 16 patients attend the Crippled Children's Schools of Chicago, viz., Fallon, Spalding, Yahn, and Sumner, and 1 patient lives at the School of Dr. Josephine Young.

During his American visit Dr. Royle operated 30 cases in all, 16 in Chicago and 14 in San Francisco, Cleveland, Philadelphia, New York, Boston, Montreal, and Toronto.

REMARKS

Cases should be carefully selected for operation   Complete data must be made before and after operation, but especially before. The patient's or parent's statements are usually of little value. If possible operate upon the nerves to the worse side first. Do not expect too striking a result immediately. If the operation will remove a block in the neuromuscular mechanism it is a very valuable procedure. The operation probably opens the gateway for the more rapid neuromuscular education or re-education. The operation is not a *sine qua non* and must

be followed by passive movements of joints and careful neuromuscular education. Do not expect the operation to correct deformities or contractures. If a monkey wrench has been thrown into a piece of running machinery, damage to the machinery is done. Removing the monkey wrench does not reconstruct the damage, but does permit repair of the damage to be made.

The operation is worth while even though it does not result in great benefit in every case. No other operation, from hallux valgus to decompression of the skull gives 100 per cent. results in the hands of any surgeon.

Many operations will be performed on improperly selected cases, by surgeons unqualified to do this work, by many who do not know what to look for, before operation and after operation

A child with Little's disease is not a decerebrate animal.

It is the writer's belief that the operation of sympathetic ramisection will probably be of definite value in certain cases of vascular disease of the extremities, such as Buerger's disease It is also highly probable that it will be of much more value in these cases than the procedure of periarterial sympathectomy introduced by Leriche This opinion is based upon the fact that there is noted immediately after the operation an increase in the vascular supply of an extremity (An accurate skin thermometer is highly desirable in determining the temperature changes) There might be an indication for it in some cases of chronic spastic colitis or ureteral spasm

Of these 16 cases, 8 were referred to Dr Royle by the writer and some of these had been patients of Dr. John L Porter. The writer was present while 15 were operated upon, he assisted in 8 of the operations,[1] and has examined 11 of the cases preoperatively and 12 postoperatively. There was no shock during or following any of the operations Hemostasis was very easy and very slight loss of blood occurred. All patients were given general anesthesia, some were operated under ethylene gas. The technic is described in Surgery, Gynecology, and Obstetrics for December, 1924. No infection occurred and all

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[1] One bilateral lumbar operation

wounds healed by primary union. There was one postoperative acidosis.

Following the cervical operation the Hoover syndrome is seen, viz., enophthalmos, narrowing of the palpebral fissure, and narrowing of the pupil on the operated side. As sidelights in postoperative observations, there may result relief of strabismus following cervical operation and relief of chilblains or hyperidrosis following lumbar operation.

There can be no denial of the fact that regardless of the value of the Royle operation, the work of Royle and Hunter has stimulated the investigation of the subject of spastic paralysis as no other recent work has. It is also of great value in emphasizing the importance of co-operation between the physiologist, anatomist, neurologist, and surgeon. It should stimulate the laboratory worker, and prove to him that his purely scientific work may have an important practical application.

A few quotations from Dr. N. D. Royle's Clinics are as follows: Those cases of spastic paralysis worth treating are those who are fairly intelligent. A straight spastic is usually fairly intelligent. The potentialities of training a defective mechanism are not good. Movement is an expression of intelligence. A conscious movement is one the end-result of which we know. Ataxia is due to loss of muscle tone—hypotonia. Spasticity is due to increased muscle tone—hypertonia. Poor balance is due to inability to quickly change position. Examine for relative increase of contractile and plastic elements. There may be no increase of contractile tone with a large excess of plastic tone. There may be great excess of plastic tone in which case knee extension is limited, and may be blocked altogether Contractile tone is shown by the excitability and degree of response. Plastic tone excess is shown by a sharp knee-jerk with maintenance of extension, or slow relaxation. A sharp jerk with quick relaxation means little plastic tone.

When trying for knee-jerk if you obtain flexion instead of extension it means the spinal reflexes predominate; it means a reflex mechanism without cortical control; it means there is no connection between the brain and cord.

Summary of Results to Date

	Number of cases	Result	
		Improved	No change
Cervical..	5	4	No report of 1
Lumbar. .	11	5	6

Cervical. Of the 5 cervical cases,
    Numbers 8, 9, and 14 have improved very definitely.
    Number 4 has improved slightly
    Number 13, no report available.
Lumbar Of the 11 lumbar cases
    Numbers 1, 2, 10, 15, 16, have improved definitely
    Numbers 3, 5, 6, 7, 11, 12, have had no practical benefit to date
Striking improvement is noted in Cases 8, 9, 14, and 16, the first three were
    cervical cases and the fourth a bilateral lumbar case
Circulatory changes were universal, in some it was only temporary
Five months after Royle operated upon Case 1, I performed a subastragalar
    arthrodesis on one foot and the hemorrhage was a great many times
    more severe than was expected, due to the loss of vasoconstriction

Case No	Name	Hospital	Assistant
1	Florence Klein	Cook County	Dr P Lewin
2	Frances Osmer	Cook County	Dr P Lewin
3.	Jeanette Skinner	Michael Reese	Dr C M Jacobs
4	Frank Davis	Wesley Memorial	Dr Loyal E Davis
5	Roy Barnes	Wesley Memorial	Dr Loyal E Davis
6	Edward Boddy	Children's Memorial	Dr B H Moore
7	Blanche Marshall	Children's Memorial	Dr B H Moore
8	Ida Horwich	St Luke's	Drs Ryerson and Lewin
9	Agnes Hasker	St Luke's	Drs Ryerson and Lewin
10	Francis Donohue	St Luke's	Drs Ryerson and Lewin
			Drs Parker and Berkheiser
			Dr Ryerson
			Dr Ryerson
15.	Robert McCormick	St Luke's	Drs Ryerson and Lewin
16.	Harold Weinthrop	St Luke's	Dr Lewin

The lower extremity usually improves faster than the upper because the lower is more automatic.

Electricity is contraindicated.

Massage is contraindicated except to favor the disappearance of fibrosis in a muscle, or to favor the development of muscle bulk.

Passive motion is very valuable. The joints should be put through their normal range of motion, if possible, twice daily.

DELAYED OR TARDY ULNAR PALSY

THIS is a report of 4 cases of tardy or delayed ulnar nerve palsy following fracture of the elbow, usually of the external condyle of the humerus. This condition is not so well known as it should be. In Case I an excellent neurologist had made a diagnosis of Landry's ascending paralysis. Duchenne, the celebrated student of neurology and muscle atrophy, diagnosed a case as spinal amyotrophy, and one of Hunt's cases was diagnosed as progressive muscular atrophy by several excellent neurologists.

Literature.—There have not been many articles on this subject. The best recent ones are those by Mouchet, Hunt, Murphy Hanes, Lusena, Sherren, Adson, and Miller.

The condition was first described by Panas in 1878, and the first American article was that of Murphy, who described one case in January, 1914.

Etiology.—The etiology is very definitely established as fracture of the lower end of the humerus, and in over 50 per cent. of cases it is of the external condyle. The injury occurs during childhood and is often improperly treated. Cubitus valgus results with gradual stretching of the ulnar nerve in or near its groove in the inner humeral condyle. Webber described one case of arthritic flexion ankylosis of the elbow with almost complete obliteration of the ulnar groove. Sherren reported a similar case.

Pathology.—Due to the irritation of the nerve there results a neuroma which causes the palsy.

The pathology in the bone is a deformity with rotation of the fragment. Non-union is the rule, although excessive callus may be found occasionally.

The carrying angle is increased, producing a valgus deformity (Fig. 408) and subsequent limitation of motion.

The ulnar groove in the internal condyle is more shallow than normal and may be almost entirely obliterated. There is dis-

turbed blood-supply to the ulnar nerve, also disturbed growth
and development of the bony structures of this area, producing
altered mechanics   The mechanical and irritative factors explain
the pathology   Murphy found traumatic neuritis due to press-
ure of an osteoma resulting from fracture in his case, Hunt found
a cystic tumor in 1 case, Sherren found interstitial neuritis plus
irregular areas of sclerosis of the perineurium and endoneurium
with atrophy of nerve fibres

   The changes in the muscles supplied by the ulnar nerve are
atrophic.

Fig 408 —Case III, illustrating cubitus valgus

Symptoms.—The symptoms are those of paralysis and de-
formity.

   The paralysis affects the muscles of the forearm and hand
supplied by the ulnar nerve, viz., flexor carpi ulnaris, two inner
heads of the flexor digitorum profundus, the interossei, the two
ulnar lumbricales, the muscles of the hypothenar eminence, viz.,
palmaris brevis, adductor minimi digiti, opponens minimi
digiti, the adductor pollicis and the inner head of the flexor
pollicis brevis   Sensory changes may appear late and may be
very slight   There is usually disturbance of epicritic but not
protopathic sensibility.

The deformity at the elbow has been described, the deformity of the hand is a typical ulnar griffe (Fig. 409).

Roentgenograms of the elbow reveal the evidence of fracture and the deformity.

Bernhardt reported a case of delayed median nerve palsy occurring thirty years after an injury to the elbow-joint in childhood. There was a fracture of the head of the radius, cubitus valgus and callous formation about the internal condyle. There was present distinct evidence of ulnar nerve involvement to which the median nerve changes were probably secondary. Hunt reported one case of combined ulnar and median delayed palsy.

Fig. 409.—Illustrating ulnar griffe.

Diagnosis.—The direct diagnosis is based upon the history of injury in childhood and after a period of from one to forty years the gradual appearance of paralysis of the muscles supplied by the ulnar nerve. The weakness is first noticed in the small muscles of the hand. Sensory disturbances may be late and slight. Roentgenograms of the elbow aid materially in making a diagnosis. The differential diagnosis is concerned chiefly with ascending paralysis of Landry, cervical rib, cord tumor, syringomyelia, tabes, and the hypothenar type of neural atrophy (Hunt) which are easily ruled out if one is on the lookout for delayed ulnar palsy.

Prognosis.—Without treatment the prognosis is poor. With good surgical treatment it is fair.

Course.—The latent period is long and varies from one to forty years. The condition is progressive.

Treatment.—*Prophylactic* treatment is very important and consists in the anatomic reposition of fractures of the humerus in young children or if this is impossible supracondylar osteotomy to correct cubitis valgus. Simple reliance on the Jones position of hyperflexion is insufficient to prevent a valgus deformity in many cases.

Curative treatment is under discussion. The various procedures recommended are as follows·

1 Supracondylar osteotomy of the humerus without treatment of the nerve.

2. Deepening the ulnar groove in the internal humeral condyle.

3. A combination of the above two procedures (Mouchet)

4. Neurolysis of the ulnar nerve.

5. Transplantation of the ulnar nerve to the flexor side of the arm to relieve its tension. Fascial tubulization by the method of *Kirk and Lewis* should be performed.

6. Hersage or longitudinal incisions into the neuroma.

7. Resection of the neuroma and suture of the nerve.

CASE REPORTS

Case I.—G N , nurse at St. Luke's Hospital, entered on the service of Dr. J. L Porter She suffered a *fracture of the right* elbow at the age of seven years At the age of twenty-two years she found she was unable to do needle work (knitting, crocheting) as dexterously as previously Examination revealed atrophy of the muscles of the thenar and hypothenar eminences, atrophy of intermetacarpal spaces, especially the first. She could not abduct or adduct the middle finger, nor could she abduct the little finger *There was tenderness* to pressure over the ulnar nerve just above the inner condyle of the humerus.

The diagnosis by a neurologist was Landry's ascending paralysis. Dr. L. J Pollock made the correct diagnosis and advised operation Dr. L. L. McArthur diagnosed neuroma of

the ulnar nerve. Roentgenograms by Dr. E. L. Jenkinson revealed the following: "There is a fracture through the external condyle of the humerus extending into the articular surface. The condition appears to be an old one. No union of the fragments has occurred, and there is some rarefaction of the fragment." At operation I found a neuroma and made several longitudinal incisions into same (hersage) with the idea of cutting the crossing fibers of the neuroma. Within three months Dr. Pollock made the following notations: "There is a return of function in all the muscles innervated by the ulnar nerve, with the possible exception of the adductor pollicis, concerning the function of which I am uncertain. There is but slight diminution of sensation, both epicritic and protopathic, over the distribution of the ulnar nerve. The electrical reactions seem fairly adequate over all the muscles. From the description of the progress since operation, it impresses me that the prognosis is good."

Case II.—R. W. E., white man, fifty-three years of age, Bloomington, Ill., patient of Dr. J. L. Porter, examined November 3, 1919.

The left hand revealed some atrophy. The left elbow was fractured forty years ago and extension has been limited ever since. About ten or twelve years ago numbness appeared in the fourth and fifth fingers, and atrophy of dorsal surface of thenar eminence with inability to abduct the fifth finger have been present. His general health had been excellent. He moved the fingers of the left hand continually in order "to keep the circulation going." He had more trouble when the hand became cold and after drawing, during which time his left arm rested on a board and circulation was impeded. He was referred to Dr. Ralph C. Hamill for confirmation of diagnosis.

Case III.—H. P., white man, about forty years of age came to Northwestern University Medical School Dispensary, where I first saw him about January 25, 1922. He had sustained a fracture of his elbow about thirty-five years ago, when he was

Prognosis.—Without treatment the prognosis is poor. With good surgical treatment it is fair.

Course.—The latent period is long and varies from one to forty years. The condition is progressive.

Treatment.—*Prophylactic* treatment is very important and consists in the anatomic reposition of fractures of the humerus in young children or if this is impossible supracondylar osteotomy to correct cubitis valgus. Simple reliance on the Jones position of hyperflexion is insufficient to prevent a valgus deformity in many cases

Curative treatment is under discussion. The various procedures recommended are as follows:

1. Supracondylar osteotomy of the humerus without treatment of the nerve.

2. Deepening the ulnar groove in the internal humeral condyle.

3. A combination of the above two procedures (Mouchet).

4. Neurolysis of the ulnar nerve.

5. Transplantation of the ulnar nerve to the flexor side of the arm to relieve its tension. Fascial tubulization by the method of Kirk and Lewis should be performed.

6 Hersage or longitudinal incisions into the neuroma.

7. Resection of the neuroma and suture of the nerve.

CASE REPORTS

Case I.—G N , nurse at St Luke's Hospital, entered on the service of Dr. J. L. Porter She suffered a fracture of the right elbow at the age of seven years At the age of twenty-two years she found she was unable to do needle work (knitting, crocheting) as dexterously as previously. Examination revealed atrophy of the muscles of the thenar and hypothenar eminences, atrophy of intermetacarpal spaces, especially the first. She could not abduct or adduct the middle finger, nor could she abduct the little finger There was tenderness to pressure over the ulnar nerve just above the inner condyle of the humerus.

The diagnosis by a neurologist was Landry's ascending paralysis Dr. L J. Pollock made the correct diagnosis and advised operation Dr. L. L McArthur diagnosed neuroma of

years previously. It is characterized by paralysis of the muscles supplied by the ulnar nerve, sensory changes, and deformity of the elbow which is usually a fracture of the external condyle with cubitus valgus. The treatment is surgical.

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CLINIC OF DR. FREDERICK CHRISTOPHER
EVANSTON HOSPITAL

SUPERFICIAL TUMORS OF VASCULAR ORIGIN

Case I.—Baby L. H. was born December 2, 1924, in the Evanston Hospital. The mother, a para one, had had tuberculosis of the sacro-iliac joint in 1920, from which she completely recovered after an illness of two years. The pregnancy, labor, and puerperium, which were attended by Dr. Frank W. Blatchford, were entirely normal. The placenta was described by Dr. J. L. Williams, the pathologist of the Evanston Hospital,

Fig. 411.—Fibro-endothelioma of chin: Before and after excision.

as being "20 x 18.8 x 2.2 cm. with fetal membranes complete and 60.5 cm. of edematous umbilical cord attached. The maternal surface is lobulated and very irregular, but the placental substance is without gross pathologic change. The placenta, fetal membranes, and umbilical cord weighed together 555 gm."

Immediately after birth it was noticed that the child had a congenital tumor of the right side of the chin (Fig. 411, A).

This tumor was about 2 5 cm. in diameter and was raised about
1 cm above the surface of the adjacent skin. It was a dark
purplish color and its surface presented a number of distended
veins. The appearance was somewhat that of a cavernous an-
gioma. This diagnosis seemed scarcely tenable as on palpation
the tumor was firm, hard, and non-collapsible. It was not
attached to the underlying mandible, but was attached to and
part of the overlying skin

The writer was called and advised early removal by excision.
This opinion was also given by Dr. Albert E Halstead, who saw
the patient in consultation Accordingly, operation was done
on December 6, 1924 (the fourth day of the baby's life) without

Fig 412 —Photomicrographs of fibro-endotheliomas of the skin

anesthesia. The skin and underlying tumor was excised through
a crescent-shaped incision whose concavity was toward the tip
of the chin There was a moderate amount of hemorrhage.
The resultant suture line was a curve running up and down and
whose convexity was posterior. This produced a scar which was
quite symmetric with the skin depression on the other side
of the tip of the chin. Despite the most careful and complete
efforts to prevent it, there was a certain amount of infection,
but otherwise the healing was rapid and uneventful The wound
was completely healed on the twenty-ninth day. The result
may be seen in Fig 411, B

Dr. J L Williams, the pathologist, gave the following

report of the specimen: "An oval piece of tissue about two-thirds of its surface covered with skin 2.5 x 2.1 x 1.4 cm. The sue with a few small tumor consists of two portion is near the skin with a thick connective some portions and has vessels (Fig. 412, A). The f spindle-shaped cells

B

of the scalp

rrounding blood-vessel he tumor is fairly well malignant. Diagnosis:

three, forceps delivery (Dr. Wm. C. Danforth). Since birth a swelling was noticed in the left occipital region. At the time of examination, when the baby was ten weeks old, the swelling measured some 3.5 x 5 cm. with a maximum elevation of 1.75 cm. It was situated to the left of the midline and its slightly irregular sur-

face suggested the underlying contours of large dilated veins. There was a slightly bluish or purplish cast to the overlying skin. The tumor was soft and boggy, but not cystic to palpation. It did not appear to be attached to the skull (Fig. 413) A diagnosis of cavernous angioma was made and removal by excision was advised

Operation was done at the Evanston Hospital on March 12, 1925, when the baby was eleven weeks old. The patient's brow and chest were allowed to rest on sand bags so that there was an air-space opposite the mouth and nose Ether was administered through this space by means of the tonsil tube and pumping engine. Elaborate precautions to preserve asepsis were made. A vertical incision was made through the scalp with especial effort to catch all bleeding points. The hemorrhage though small absolutely was relatively large enough to cause no little anxiety. Fortunately a cleavage plane between the tumor and skin was found and the former was rapidly freed and removed. In the upper part, where the cleavage plane was less apparent, it is possible that a small portion of the more solid portion of the tumor was left behind. The baby was very white immediately after the operation and 100 c.c. of Ringer's solution was given under the skin. From this time the patient rallied promptly and the wound healed quickly without infection. There remained a very small swelling at the upper angle of the incision

The report of the pathologist of the Evanston Hospital, Dr. J. L Williams, is as follows "A piece of soft red and pink tissue roughly oval, $4.5 \times 3.0 \times 1.4$ cm Cut surfaces are grayish pink and con tain a few dilated blood-vessel spaces. Apparently the tumor consists of two portions, the larger, $3.3 \times 2.5 \times 1.4$ cm , and a smaller adherent piece, $2.0 \times 1.5 \times 0.8$ cm Microscopic This tumor contains dense connective-tissue stroma with many enlarged blood-vessel spaces surrounded by spindle-shaped and polyhedral cells and arising, apparently, from the endothelial lining Some of the blood-vessel spaces are of considerable size and filled with blood and the endothelium is hypertrophic and neoplastic Diagnosis Hemangio-endothelioma "

Four months after operation the scalp is flat and there is no perceptible trace of the tumor.

Case III.—Patient, A. W., aged nine, was first seen at the Out-patient Department of the Evanston Hospital on March 12, 1925. It was learned that three months previously she had been struck by a snowball on the face just lateral to the outer angle of the left eye. The day following this there was a flat red area at the site of the injury, and two to three days later this red area began to become swollen and enlarged to the size of the tip of her finger. On examination there was found to be a small bright red tumor about 2 to 3 cm. lateral to the outer canthus of the left eye. It was somewhat pedunculated, its surface was smooth, almost glistening, and the skin surrounding the base was reddened to a diameter of 1.5 cm. On March 16, 1925, it was excised under local anesthesia. The wound healed cleanly. The report of the pathologist of the Evanston Hospital (Dr. J. L. Williams) is as follows:

"An oval piece of skin 1.0 x 0.5 x 0.4 cm., containing a small amount of subcutaneous tissue and a soft papilloma, 0.4 cm. in diameter and 0.3 cm. thick. Microscopic: Sections of this tissue disclose numerous spindle-shaped and polyhedral cells generally arranged about small blood-vessel spaces, and having the general structure of an endothelioma. One large blood-vessel near the center of this tumor is partially filled with a recently formed thrombus. There is no evidence of malignancy seen in any of the sections. Diagnosis: Endothelioma."

DISCUSSION

The differentiation of tumors into the two classifications, congenital and acquired, may be very difficult or even impossible in the strictest scientific meaning. Such a distinction must of necessity be clinical and as such have considerable interest. In 1900 Senn[1] remarked that, "in a certain sense the majority of tumors are congenital in so far as the essential matrix of embryonic cells is concerned. It is only in cases in which a tumor develops from a matrix of embryonic cells of postnatal origin

that the essential tumor matrix is not congenital. When we speak of a congenital tumor, however, we mean a tumor which is present at the time of birth."

Tumors of infancy and childhood may then, in fact, be congenital in origin, but clinically not apparent until some period after birth. Statistical information as to the incidence and types of tumors of childhood is difficult to obtain. Perhaps the most interesting study is that of Serg Marc[e] which was published in 1891. This author examined the records of foundlings' homes in Petrograd and Moscow. In a period of fourteen years there were 5020 surgical admissions and of this number 121, or 2.4 per cent, were for neoplasms, 37 cases were in the first year, 35 from one to six years, 36 from seven to twelve years, and 5 over twelve years of age, 60 per cent., were in females The diagnoses given were as follows

Diagnosis	No. of cases	Per cent
Angioma	46	38 0
Sarcoma	13	11 0
Cystoma	10	8 3
Papilloma	9	7 4
Lymphoma, malignant	8	7 0

Diagnosis	Each	Per cent
Polypus, hygroma, atheroma	5	4 1
Lipoma and epulis	3	2 5
Chondroma, lymphangioma granuloma, struma, ranula	2	1 6
Fibroma, glioma, adenoma, keloid .	1	0 8

A further study of 426 cases in Moscow revealed 33 tumors, or a percentage of 7.74; 54 per cent were in females, 10 were found in the first year of age, 14 from one to six years, 8 from seven to twelve, and 1 at thirteen years The diagnoses were as follows

Diagnosis	No. of cases	Per cent
Angioma .	11	33 3
Glioma .	5	15 1
Polypus .	4	12 0
Sarcoma	3	9 0
Atheroma, fibroma . each	2	6 0
Cystoma, epulis, lipoma, hygroma, elephantiasis, ranula . each	1	3 0

At the Evanston Hospital among 1477 newborns in thirty-two months, but 3 congenital tumors were noted (an incidence of 0.2 per cent.). Of these one was a hemangioma of the forehead, one a cavernous angioma of the scalp, and the other a fibro-endothelioma of the chin.

Angiomata, then, are by far the most common tumors of childhood. They are nearly always congenital.[1] Congenital sarcomata are by no means rare.[3]

Walker[4] collected 138 cases of sarcoma of the kidney. Of these he classed 12 as congenital, although all were probably embryonic in origin.

Ewing[5] defines an angioma as a "tumor composed of newly formed vessels." Both blood- and lymph-vessels are subject to neoplastic growth, giving two classes of tumors, hemangioma and lymphangioma. Hemangioma may be divided into hemangioma simplex and cavernous angioma. Angiomata having widely dilated vascular channels and thin connective-tissue septa are called cavernous. Cavernous angioma may be found in all parts of the body, but chiefly in the subcutaneous tissue of the face, scalp, labia, scrotum, prepuce extremities, and folds of the knee, axilla, and buttocks.[5] When allowed to progress they may attain very large dimensions, and successively invade neighboring tissue and organs.[5]

"The term 'endothelioma' is applied to an extensive group of tumors which are believed to be derived from the living cells of blood-vessels, lymph-vessels and spaces, subdural spaces, and serous cavities."[6]

Certain tumors combine the characteristics of both an angioma and an endothelioma. These growths are of the type of angioma, but exhibit an excess of endothelial cells. They are referred to as hemangio-endotheliomata (Case II).

Angiomata are benign tumors, yet they may cause pressure absorption of neighboring tissues (bones), and, moreover, bleeding from an angioma may be dangerous.[7] Bland-Sutton[8] classifies endotheliomata as malignant. This statement, however, is unquestionably too drastic and too inclusive. Borst[7] considers that some of the malignant tumors of angioma structure

should be called hemangio-endotheliomata. Moreover, it may not be a far cry from hemangio-endotheliomata to angioblastic sarcomata.

Cavernous angiomata may be distinguished from aneurysm by the absence of pulsation in the angiomata,[9] by the slight impression produced upon the size by compression of the main artery, and in the fact that angiomata, as a rule, are subcutaneous and involve the skin, causing a distinct discoloration.

Congenital tumors, when proper, should be removed early, first, to limit increase in size and possible invasiveness; second, to remove an object which is unsightly.

Angiomata of the lip should be dealt with promptly, as they are apt to grow rapidly in this locality.[10] Congenital angiomata of the tongue, according to DaCosta,[11] sometimes, though seldom, undergo spontaneous disappearance; acquired angiomata of the tongue never disappear spontaneously.

Cushing[12] says that, "the thick projecting masses of spongy tissue which constitute isolated tumors of the cavernous type are suitable for excision, but where these growths are upon the scalp and have invaded the bone, surgical interference with the knife is attended by great risk of fatal hemorrhage."

Halstead[13] recommends the treatment of cavernous angiomata by ligation of efferent vessel, and, a few days later injection of the tumor with boiling water.

Clark[14] shows two beautiful results of the treatment of angiomata by electric desiccation (high-frequency cauterization).

CONCLUSION

Three cases of endotheliomatous superficial tumors are presented. In each case the tumor was removed by excision. Two tumors were congenital and the third acquired. The feasibility of the removal of these tumors by the knife is illustrated in these cases.

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CLINIC OF DRS. R. W. McNEALY AND JULIUS SPIVACK

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AXILLARY ANEURYSMS

STATISTICS bearing on the relative frequency of aneurysms, the varieties and their treatment, are usually based upon collective reports following a war. While such statistics are, in a way, very illuminating, they may be, and often are quite misleading. We need more detailed reports of the experiences of surgeons who treat these vessel lesions in civil life where the work may be done under favorable conditions and the end-results observed.

It should be the aim of surgeons who have the opportunity of treating blood-vessel injuries to crystallize their views in order that a fairly definite working plan may emerge from the rather chaotic condition of our present knowledge. We have found it extremely difficult to secure the desired information from present literature, and for this reason we have attempted to set forth our views concerning the treatment of aneurysms of the axillary artery.

Aneurysms of the axillary artery occur less frequently than those of many other peripheral vessels, yet the absolute number is quite large. In the statistics given by Crisp there are recorded 551 cases of which 31 per cent. occur in the thoracic aorta; 10.5 per cent. in the abdominal aorta and its tributaries; 25 per cent. popliteal; 11 per cent. femoral; 4.1 per cent. subclavian; 3.6 per cent. innominate, and only 3.2 per cent. are axillary.

Spontaneous aneurysms of the axillary are an extremely rare occurrence. The small penetrating wounds of sharp high velocity firearms cause many of the traumatic aneurysms and these are very often of the arteriovenous type. We find this tendency to

arteriovenous aneurysms most marked in the neck, Scarpa's triangle, and in the axilla   They are of slightly less frequency in the axillary than in the two former, due to the close relationship between the artery and the numerous cords and trunks of the brachial plexus   While firearms produce the majority of traumatic aneurysms there are cases on record produced by stabs, fracture with dislocations of the humerus, and by dislocation of the humerus alone.   In the spontaneous variety lues is the dominant cause, although cases have followed suppuration in the axillary space and one case is recorded as produced by echinococcus

SYMPTOMATOLOGY

In cases of spontaneous aneurysm one may observe a pulsating tumor mass whose pulsations are synchronous with the heart beat and diminish or disappear when the vessel is compressed proximally.   Bruits are heard over the sac and occasionally a thrill may be felt, although this usually implies the existence of an arteriovenous aneurysm.   More or less edema of the extremity and the overlying subcutaneous tissue may give evidence of the venous stasis, due to pressure on the venous radicles   Retardation or diminution of the radial pulse is usually apparent   Nerve lesions of the median, radial, or ulnar divisions may be present, due either to concomitant injury or to pressure.   Two of our cases had concomitant injury to the large nerve trunks   An interesting case is reported by Babinski and Heitz, in which there developed a marked hyperthermia of the upper extremity after removal of the aneurysm sac   In one of our cases the inner head of the median was traversed by a small caliber missile which also traversed the axillary artery.   This patient showed some paresis of the hand, but complained more particularly of paresthesias over the course of the cutaneous branches   In our other case a typical picture of musculospiral paralysis was present.

Aneurysms of the arteriovenous type often present few evidences of their existence.   Many such cases have been accidentally discovered when the patient applied to the surgeon for

removal of a bullet in the soft tissues. The presence of the loud purring, whirling, or machine-like murmur, heard most distinctly over a well-circumscribed area of the axillary vessel and accompanied by a plainly palpable thrill, leaves practically no doubt of the presence of an arteriovenous aneurysm. In arteriovenous aneurysms there is also present in most cases a fairly well-marked dilatation or varicose condition of the superficial veins, especially the cephalic branches

The prognosis in cases of axillary aneurysm varies as do the clinical pictures of the unobtrusive aneurysm varix and the rapidly spreading dissecting aneurysm. The concomitant injury of the large nerve trunks adds considerably to the gravity of the injury and the uncertainty of the prognosis.

TREATMENT

It may give us a better perspective if we review the suggestions made by such an eminent surgeon as Sir George Makins in his monograph, Gunshot Injuries to the Blood-vessels. In discussing the methods of treating his series of axillary vessel injuries and aneurysms he confessed that his early work was rather desultory owing to his imperfect realization of the true lines which should be followed. A brief synopsis of his operative procedures is as follows: 1. The third part of the subclavian artery was ligatured in continuity in 7 cases. In 2 of these that was the only procedure. 2. In 3 cases the third part of the subclavian was combined with distal ligature of the third part of the axillary artery. 3. In 2 cases the subclavian was ligatured for the treatment of secondary hemorrhage occurring after local ligature of the axillary artery. 4. In 1 case primary suture of the wound in the artery was done. 5. In 4 cases double ligature and division of the intervening part of the artery as a primary measure. All did well. 6. In 7 cases ligation of artery and vein was done simultaneously. 7. In 5 cases ligature of the artery alone was done.

It is true that not all of the above cases are aneurysms, yet they give us much light on the various possibilities to be thought of in connection with our work in this area.

extends obliquely outward crossing on to arm about 1 inch above the anterior axillary fold. We divide the pectoralis major about 1½ inches from its insertion and reflect it toward the midline with the overlying skin and subcutaneous tissue. In many cases, especially where the lesion is in the third portion of the axillary, it is unnecessary to cut across the pectoralis minor. If it is found advantageous, the pectoralis minor may be cut across just below the coracoid process and reflected with the pectoralis major. The brachial plexus and axillary vessels are now fully exposed, covered only by the semitransparent axillary fascia.

DISSECTION OF NERVE TRUNKS

If there has been any indication of nerve injury, great care must be taken to dissect out the various nerve trunks that they be not further injured in the course of the operation. Many times the nerve trunks will be found spread out and plastered to the vessel wall by adhesions.

MANAGEMENT OF ANEURYSM

While we all admit that restorative operations, either by end-to-end anastomosis or by the arteriorrhaphy method of Matas, are the most spectacular, we must also admit that they are often the least trustworthy and most disastrous when they fail by reason of thrombosis, hemorrhage, or infection. We have come to believe that ligation above and below the sac with partial or complete extirpation of the sac gives the most uniform results. In some cases the ligation above and below the sac may be augmented by obliterative aneurysmorrhaphy, as suggested by Matas. If possible the peripheral ligature should be applied proximally to the subscapular artery. In all cases this vessel must be given consideration, since it has led to considerable trouble in many cases.

CONCOMITANT VEIN LIGATION

One of us (R. W. M.) has elsewhere expressed himself on the question of concomitant vein ligation in the treatment of peripheral aneurysms. We believe that where the main artery

is ligated the main vein should also be ligated. In the axillary approach we try to preserve the cephalic vein.

RESTORATION OF MUSCLE GROUPS

We have found little difficulty in suturing the divided muscles with mattress-sutures of chromic catgut. Functional results are nearly perfect. Two of our cases are now doing heavy manual labor and experience little difficulty.

DRAINAGE

Next to scrupulous hemostasis we believe that avoidance of serum accumulation in the axilla is of the greatest importance. We place relatively few interrupted skin sutures along the line of incision and near the lower end we insert a small folded gutta-percha or rubber drain, which is left in for about twelve hours only.

POSTOPERATIVE MANAGEMENT

We do not use roller bandages, but apply a large combination pad dressing held firmly in place by adhesive strips.

The arm is allowed to lie in a natural position on the bed and a therapeutic light is arranged under a blanket tent to afford heat to the part.

We encourage the patient to move his forearm and fingers as soon as he is awake. These exercises are continued throughout the convalescence increasing their limits as soon as possible.

Histories of three patients illustrating the types of aneurysm just described follow:

Case I.—Negro, male, aged thirty-nine years. Admitted to Cook County Hospital February 15, 1924. Bullet wound of right axilla twenty-six days previous. Pain and weakness of arm cause for entrance. Operation February 17, 1924. Well-circumscribed arterial hematoma or dissecting aneurysm following around spiral groove of humerus. Inner head of median nerve was perforated by bullet, but not severed. Usual incision and muscle division followed by provisional ligature of first

portion of axillary Ligature placed above and below aneurysm of second portion of axillary artery and the aneurysm sac dissected out. Axillary vein was ligated. Two small gutta-percha drains inserted Wound healed by primary union. Patient discharged March 10, 1924. Paresis and paresthesias much improved Returned after three months with no pain and only very slight sensory disturbance of thumb and first two fingers. Is doing heavy manual labor

Case II.—White, female, aged forty years Admitted to Cook County Hospital August 17, 1923 Examination revealed bullet wound in right infraclavicular region. Right radial pulse imperceptible at time of admission. Several hours later radial pulse of right side had not only become perceptible, but was nearly equal that of left. Systolic pressure in left arm 130, in the right 96. Patient complained of extensive pain in axilla and shoulder. Findings indicated arterial hematoma of right axillary artery with concomitant injury of radial nerve Operation August 26, 1923 Usual incision and muscle division. Provisional ligature of first portion of axillary just below clavicle. Cords of brachial plexus were adherent to artery and had to be dissected free. Ligature of artery above and below vessel injury No attempt made to dissect ligated segment. Axillary vein ligated. Search failed to reveal a lesion of musculospiral nerve We did not attempt too great a dissection for fear of increasing likelihood of gangrene Usual closure with small drain. Primary union Patient discharged October 5, 1923. Circulation in extremity good, but musculospiral paralysis still existed with no improvement.

Case III.—Negro, male, aged thirty was admitted to Cook County Hospital April 24, 1923 Patient had bullet wound of right axilla August 6, 1922. Came to hospital because of dull aching pain in back which he believed was due to presence of bullet in soft tissues. Examination revealed a pulsating swelling in region of second portion of axillary artery. A distinct machine-ike bruit was heard all over right side of chest, but most

marked over tumor mass.   Thrill was palpable over tumor mass. Superficial veins of arm were markedly dilated.   No murmurs were found on examination of heart, although the cardiac shadow was increased.   Operation May 3, 1923.   Usual incision and division of muscles followed by provisional ligature of first portion of axillary artery.   Provisional ligature distal to arteriovenous aneurysm was also applied.   Arteriovenous aneurysm of third portion of axillary artery was found.   Quadruple ligation was done and aneurysm was dissected out.   Considerable difficulty was met in controlling bleeding from collaterals. Usual closure with small pack left in aneurysm bed.   Slight infection followed which rapidly cleared, and patient was discharged May 28, 1923.   Returned for several dressings and made an excellent recovery.   On August 11, 1924, this patient was readmitted with a cellulitis of right shoulder and chest.   Incision was followed by considerable hemorrhage.   Wound cleaned up shortly and patient was discharged August 25, 1924.   Has since been working at hard manual labor.

CLINIC OF DRS. KARL A. MEYER AND WILLIAM A. BRAMS

COOK COUNTY HOSPITAL

THE DIAGNOSIS AND TREATMENT OF HOUR-GLASS STOMACH

THE first case we wish to present before you is of interest because it illustrates one of the possible complications of chronic gastric ulcer and because the clinical recognition of this complication has been attended by some difficulty until the Roentgen-ray came into general use as a diagnostic aid in the field of gastro-intestinal medicine and surgery. This patient is of further interest because there is considerable divergence of opinion as to the best surgical procedure to employ in these instances and our purpose in demonstrating this patient is to illustrate the reasons for and the technic of the operation employed in this case, with apparently good results.

The patient you see before you is a white male, twenty-six years of age, and a machinist by trade. He was admitted to the surgical service of the Cook County Hospital on January 10, 1925, with a complaint of having been ill for the past three years. His present trouble began gradually with epigastric pain which occurred about an hour and a half after meals. These pains were severe and often awakened him at night. The pains were formerly relieved in a few minutes by food or warm water, but would again recur in about an hour. This relief has become less marked recently and the pain has become more severe and persistent. Bowel movement relieves the pain a little, but soda bicarbonate, which formerly gave relief, now increases the burning sensation. The patient vomited a large quantity of blood two years ago. Tarry stools persisted for

about three days following this copious hematemesis, but no blood has been vomited since. A full meal, however, was often followed by a feeling of distension and by vomiting. The patient has lost about 6 pounds in weight, the appetite has been poor, and moderate constipation has been present since the onset of the trouble. There is nothing of importance in the past or family history.

Examination of this patient shows a very anemic and thin individual with normal pulse, temperature, and respiration. Examination of the thorax showed the presence of mitral stenosis. There was no tenderness of the abdomen and examination of the genitalia and extremities showed nothing abnormal. An Ewald test meal removed in an hour showed free HCL 15 and total acidity 30. *The stools contained occult blood in six of seven examinations and then was negative in seven further tests* The blood chemistry showed nothing abnormal. The blood Wassermann was negative. The white blood-count was 7600 and the urine was negative

A study of the foregoing history reveals two interesting features. The first is the fact that the epigastric pains eventually became more severe and persistent and were no longer relieved by soda Such a change from a clear-cut ulcer history to a clinical picture in which the pain begins to lose its definite relation to the time of eating and is no longer relieved by the ordinary measures usually means the presence of some complicating factor which influences the character of the individual symptoms so that they are no longer typical. Such complications may be in the nature of a malignant degeneration, adhesions, stenosis, or spasmodic contracture of the stomach. The onset of such a change in the character of the pain and other symptoms should at once prompt us to determine the nature of the new pathologic factor responsible for this change, in order that the corresponding treatment may be instituted. Malignant degeneration, especially in the early stages, can be determined with certainty only by histologic examination, but can be ruled out to a certain degree in view of the fact that occult blood disappeared from the stools after rigid medical treatment. Further

examination of the patient by physical and laboratory methods and by x-ray may reveal such other complications as stenosis, adhesions or spasm of a portion of the stomach.

The second point of interest in the later part of the history is the fact that vomiting followed the eating of a heavy meal. This symptom may be due to a number of causes, but a very common anatomic reason for vomiting following the ingestion of larger quantities of food than usual is a reduction in the capacity of the stomach either by virtue of shrinkage, infiltration, or stenosis of the body of the organ. The supposition that some such reduction in the capacity of the stomach was present was confirmed by x-ray examination, which showed a marked hour-glass deformity of the stomach opposite a large ulcer niche which was located on the lesser curvature at the pars media. A defective duodenal bulb with dilatation of the duodenum proximal to this defect was also noted. The patient was placed on a rigid Sippy management in order to improve his general condition before operation was considered, and another x-ray taken one month later to rule out a possible spasmodic condition showed the same hour-glass deformity of the stomach. The question of a change in treatment now presented itself, in view of the fact that the Sippy management produced no marked relief and also in view of the fact that the treatment of hour-glass stomach is essentially surgical. While it is true that spasmodic stenosis may usually be overcome by conservative management and that organic stenosis may sometimes be improved clinically by medical measures, surgery must be considered as the most certain means of overcoming a definite organic change in the contour of the stomach resulting either from stricture, connective-tissue infiltration, or adhesion to a neighboring structure. The choice of operation depends upon the condition of the patient and the changes actually found after the abdomen is opened. A patient who is a poor surgical risk should be operated only by the simplest method, while those who are in fairly good condition should have a resection of the pyloric antrum including the ulcer and contracted parts of the stomach. A gastro-enterostomy should then be performed, uniting the

ptoximal part of the stomach to the jejunum. This is the ideal procedure as it at once removes the lesion, it provides an ample passageway for the food, it removes the ulcer and ulcer-bearing area, and produces a marked reduction in the acidity of the stomach contents as pointed out by us elsewhere, and thus counteracts some of the factors which could favor the recurrence of the ulcer or its complications. Another argument in favor of pyloric resection with gastro-enterostomy is the fact that pyloric or duodenal ulcer or stenosis in these regions occurs in about 20 to 25 per cent. of cases in which an ulcer is located in the pars media of the stomach. This double stenosis is a factor which must be remembered, as any procedure which leaves out of consideration the possibility of a pyloric stenosis accompanying an hour-glass stomach may result in complete failure.

Resection, of the pyloric antrum, including the ulcer and the scar tissue as well as the contracted portion of the stomach, was accordingly performed in this instance because the patient was a fair surgical risk and because the operation was considered feasible in spite of the complicated pathology found after the abdomen was opened The stump of the stomach was brought through a bloodless portion of the mesocolon and anchored to it by linen sutures A gastro-enterostomy was then performed, uniting the stump of the stomach with a loop of jejunum according to the Polya method The patient made an uneventful recovery and was discharged from the hospital feeling perfectly well and having no symptoms

The second case, also one of hour-glass stomach, is of interest because it illustrates the formation of this deformity as a result of perigastric adhesions rather than by actual scar stenosis from the lesion in the stomach wall itself, as occurred in the first case. This patient is also of interest because the underlying pathology was so extensive that only a gastro-enterostomy at the proximal pouch was feasible.

The patient is a laborer forty years of age, and was admitted to the Cook County Hospital with a history of having had severe digestive disturbances for the past three months. The symptoms had become much worse in the past week and his chief

complaint at the time of admission was severe, sharp, epigastric pains associated with vomiting and coming on a few minutes after meals. He stated that he had vomited about 2 quarts of blood about two years ago. Examination two years ago revealed a poorly nourished male with normal pulse, temperature, and respiration. Nothing abnormal was found in the chest, but definite tenderness and rigidity were present in the upper portion of the abdomen. The white count was 17,800, the urine was
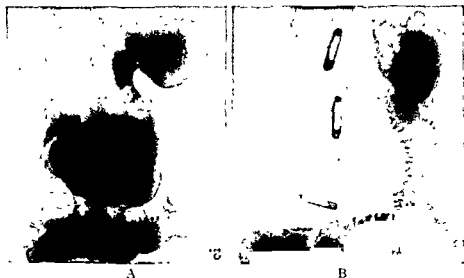

Fig. 415 —A, x-Ray of Case I showing condition of stomach before operation in which a large ulcer niche is seen at the pars media of the stomach and two large pouches forming an hour-glass deformity of this organ. B, The adjoining picture shows the condition of the stomach after operation at which time a resection of the pyloric part was performed, together with a gastro-enterostomy according to the Polya method.

normal, the Wassermann of the blood was negative, occult blood was present only once in the stools, and the stomach contents showed free HCl acid 40 and total acidity 60. There were no evidences of retention of the gastric contents. In view of the fact that the pain had become more severe and persistent, it was decided to examine the patient fluoroscopically in order to determine the complication which had aggravated and altered the clinical picture. Free fluid and air in the peritoneum was visualized by fluoroscopy without the use of a barium meal, thus

absence of free HCl in the stomach contents, the visible peristalsis, and the presence of a filling defect on x-ray examination The constant absence of blood from the stools on numerous occasions does not, however, fit in well with the other findings
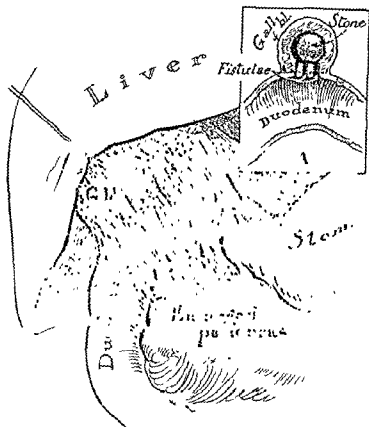

Fig 416 —Drawing of condition found at operation in Case JII, showing dense and massive adhesions binding stomach, duodenum, gall-bladder, and pancreas. Insert A shows the three fistulous tracts between the gall-bladder and the duodenum

Malignancy of the stomach is usually betrayed by the presence of occult blood in the stools and should certainly have been found at least occasionally in the series of nine tests performed on nine different days.

In view of the fact that a good history could not be obtained

and that occult blood was constantly absent from the stools, exploratory operation was decided upon. A midline incision was made in the upper abdomen and adhesions uniting the stomach, liver, and gall-bladder were divided. The duodenum was adherent to the gall-bladder and on being separated from one another a large, foul-smelling abscess was discovered. The abscess was incised and sponged out. Three fistulous tracts were found connecting the gall-bladder and duodenum. The fistulæ were closed in by linen sutures, the gall-bladder was incised, and a large stone removed, after which the cystic duct and gall-bladder were extirpated. In view of the stenosis at the outlet of the stomach due to the inflammatory reaction and peri-duodenal adhesions, it was decided to perform a posterior gastro-enterostomy. This operation was carried out as previously described after a careful search failed to reveal evidence of malig-nancy. The wound was closed tightly, but drainage was pro-vided by a strip of iodoform gauze in a cigarette drain through a stab wound under the right costal margin. The patient made an uneventful recovery and was discharged feeling perfectly well three weeks after operation.

CLINIC OF DRS. EDWIN M. MILLER AND RALPH C. BROWN

PRESBYTERIAN HOSPITAL

CHRONIC DUODENAL ILEUS

IT is our purpose this morning to discuss with you an abdominal condition which, though probably of frequent occurrence, is not generally recognized, and only during the past few years has been successfully treated. We refer to chronic obstruction of the duodenum.

The cause of this condition varies with the part of the duodenum involved. In the first portion close to the pylorus it frequently is the result of scar tissue narrowing, either from an old ulcer or from adhesions following a duodenal or gall-bladder infection. This type is easily recognized and, as a rule, is effectively handled by resection or gastro-enterostomy. In the second portion, extending between the duodenal cap and the lowermost part of the descending loop chronic narrowing is less commonly observed, and when present at all is associated with inflammatory lesions of the pancreas, tumors of the pancreas, enlarged retroperitoneal glands, or duodenal diverticuli. Not infrequently there is found a congenital band, or an old adhesion stretched across between the colon, duodenum, and gall-bladder. Ochsner in 1905 described in this region a true sphincter muscle which acting reflexly in response to stimulation lower down he believed may at times cause stasis of the duodenal contents and perhaps be an etiologic factor in the causation of duodenal ulcer. It is with the third portion, however, that we are in particular concerned, and to which we must direct our attention in seeking the most common cause of chronic duodenal obstruction, because the embryologic development of the retroperitoneal and terminal segments of the duodenum brings into close relation structures

that might easily infringe upon the normal caliber of the bowel
In the four-footed animals the entire duodenum is a free intra-
peritoneal loop and the mesentery hangs downward freely in
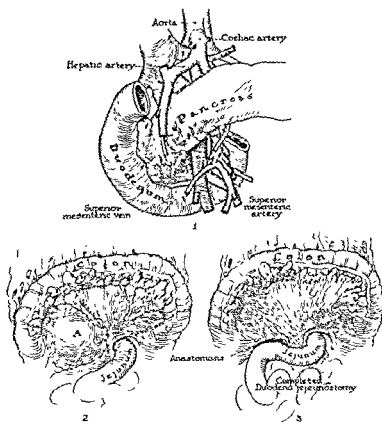the perpendicular plane, but in man, as a result of the upright

Fig 417 —1 Normal anatomic relations of the retroperitoneal part of
the duodenum 2 Dilated retroperitoneal part of the duodenum shown at
A 3 Appearance after anastomosis between the dilated duodenum and a
proximal loop of jejunum

position and the rotation of the large bowel around the root of
the mesentery as a pivot, the third portion of the duodenum
assumes a precarious position in the angle between the vertebral
column and great vessels behind and the root of the mesentery

in front (Fig. 417, 1). The lumen of the bowel therefore is subject to change in caliber by influences that would either bring forward the vertebral column, such as curvatures of the spine, or would increase the drag on the overlying root of the mesentery, such as ptosis of the stomach, colon, or the abdominal viscera, in general. Moreover, the duodenojejunal angle suspended as it is by the fixed and invariable ligament of Treitz is subject to change in degree by forces which increase or decrease the drag on either one or both of its loops. These factors, together with the frequency of anomalous arrangement of the peritoneal folds and fossæ in the region of the jejunal angle, furnish ample opportunity for interference, either intermittently or constantly with the normal caliber of the duodenum.

The clinical manifestations of this condition likewise vary with the point of obstruction and depend upon whether the narrowing is persistent or intermittent in type. It is unnecessary here to dwell upon the familiar picture of obstruction of the first portion, so closely does it simulate that of the pylorus and so readily does it respond to well-recognized methods of treatment. Nor need we lay stress upon the occasional case of obstruction in the second or descending loop; our main object here is to call your attention to that rather peculiar symptom complex arising from narrowing of that part of the duodenum lying behind the peritoneum and beneath the mesenteric vessels. This condition was recognized and well established as a pathologic and clinical entity by Rokitansky as far back as 1849, and since that time has been clearly depicted in the medical literature by Glenard, Albrecht, Robinson, Codman, Wilkie, Bloodgood, Kellog, Crouse, and others. The patients are most often women, usually of the visceroptosis type. The symptoms often ill-defined, cover a long period of time, with mild digestive disturbances, distress after meals, belching of gas, frequent headaches, occasional nausea, and often periods of vomiting. At intervals these symptoms become markedly exaggerated, often to the point of a severe attack, in which there is extreme pain, often severe vomiting, not infrequently a rise in temperature, and occasionally jaundice. Each succeeding attack becomes

more severe, many pounds of weight are lost, and at last the patient is apt to become a physical and mental wreck.

The recognition of the true condition is not always a simple matter. Reports from the literature show that it is frequently mistaken for appendicitis, gall-stones, or stomach ulcer, and not a few of these patients have been operated upon once, twice, or even three times before an accurate diagnosis is made. Typical, though extreme, is a report by Wilkie in 1921, in which after an appendectomy there was later a gastro-enterostomy, later an entero-enterostomy, and finally death. The autopsy revealed a definite obstruction of the duodenum beneath the mesenteric vessels. Since the use of the fluoroscope has become such a routine procedure in cases with vague abdominal distress, not a few have thus been recognized which might otherwise have remained a question of doubt. In a well-defined case the stomach will be seen to hang low, fills easily, and exhibits strong peristaltic waves. The duodenal cap is normal and the barium readily passes into the duodenum. Here one soon observes an accumulation and as this goes on a dilatation is seen in the lowermost part, which may increase the width of the bowel even to twice its normal size. Peristaltic and antiperistaltic waves become very strong and after churning back and forth the barium in small amounts is forced upward past a high-lying duodeno-jejunal angle and finally fills the bowel beyond.

The treatment of this type of chronic or intermittent duodenal ileus obviously depends upon the severity of the symptoms and the period at which the case is seen. In the intervals, proper control of the diet is highly essential, and should be so regulated that constipation is entirely overcome. Change in posture to the recumbent position immediately after meals may materially lessen the drag of the mesentery and effectively forestall the distress of which other patients complain. Mild cases may in this way be carried along in comparative comfort for a long period of time and thus avoid the more radical measures which must necessarily be adopted when other means have failed. In the older days gastro-enterostomy was the rule and occasionally it gave relief, but too often the trouble was either not affected

at all or made worse by this procedure. Finney in 1906, while presenting such a case at the Johns Hopkins Hospital, commented upon this fact, and during the discussion that followed his remarks, the suggestion was made by Dr. Barker that perhaps an opening between the dilated duodenum and the jejunum might have a better effect. The idea found enthusiastic support and in the following year Dr. Stavely of that institution performed the first duodenojejunostomy using a Murphy button, and the result was a gratifying success. Since that time this method of procedure has become widely adopted and the large number of favorable reports in the literature are evidence of the soundness of the idea upon which it is based.

We are fortunate in having to present to you a typical case of this kind, and the details of his history, the method of treatment, and the end-result are of more than usual interest. This young man, twenty-four years of age, came to the hospital January 29, 1925, giving us in brief the following account of his complaint.

For the past ten or eleven years he has been subject to peculiar abdominal attacks, coming on at first once or twice a year and more recently every few months. At these times he is seized with rather sudden cramp-like pains in the pit of the stomach, which are sometimes severe enough to double him up. They last off and on for four or five days at a time, subside gradually, and leave him in a weak and exhausted condition. He has been taken ill while in many different parts of the country, has seen many different doctors, and has had many different diagnoses made, all without permanent relief. Between times he is in fairly good health, but as long as he can remember he has had difficulty in moving his bowels. At first the attacks were rather mild, but as time went on they became more frequent and each succeeding one became more severe. The one that occurred January 21st is typical of all the rest and a brief account of it may be of interest. He had been out the evening before with some friends at dinner, and though he returned home very late, retired at 2 A. M. feeling well. He was awakened at 5 o'clock by severe cramp-like pains in the epigastrium, which

soon radiated over the entire abdomen He could not remain in bed, so paced the floor doubled up, and aroused the family, who tried in vain to give him relief. A physician arrived at 9 o'clock, found him in a cold sweat, with a temperature of 104° F. and badly in need of a hypodermic. There was no diarrhea and no urinary disturbance The attack gradually subsided and he came into the hospital January 29th While under observation for a period of five days nothing further of importance was obtained in the history and no marked physical findings were detected. There was generalized soreness over the abdomen, no rigidity, and no distention. Venereal disease had been denied and the Wassermann was negative He was discharged feeling well on February 4th, at 3 P M., with instructions to report at onset of next attack. No sooner had he reached home than he was seized with another severe attack, identical with the one described, except that nausea and vomiting were a prominent part of the picture. *When brought back to the hospital at 8 P M he was doubled up with pain and the abdomen, though not distended, was rigid in the upper half. The temperature was normal, urine negative, and leukocyte count 20,000.* Vomiting continued at intervals during the evening, the pain came and went in a rhythmic manner, and at times peristaltic waves could be seen. The following day the fever began to rise (reaching 102° F. rectally), the pain and vomiting recurred at regular intervals and between times he would perspire and relax as if completely exhausted.

By this time it had become evident that we were dealing with a high intestinal obstruction and that if proper measures were not soon begun a fatal termination might result. It might be well here to state that during the past few years a good deal has been learned about high intestinal obstruction and the systemic changes produced by the accompanying toxemia. MacCallum and his co-workers have shown clinically and experimentally that there occurs a marked fall in the plasma chlorids, an increase in the blood urea, and a rise in the CO_2 combining power of the plasma. This has been confirmed clinically by McVicar, Dixon and others and proved experimentally

on dogs and rabbits by Haden and Orr. It was upon this basis that normal salt solution rectally was started at once and continued without interruption, until the vomiting had ceased, the pain had subsided, and the temperature had returned to normal. Within a few days he was able to take a nourishing diet, and on February 7th a fluoroscopy was made. Although all clinical signs of obstruction had at that time completely passed away there was a distinct dilatation of the duodenum (Fig. 418) still
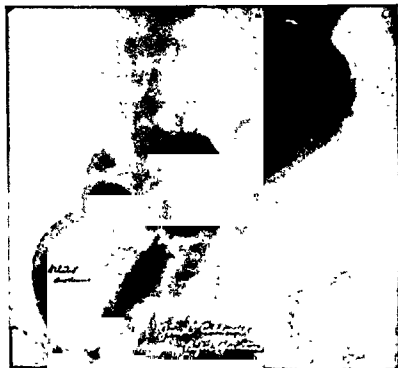

Fig. 418

present and a marked delay in the passage of the barium past the duodenojejunal angle. A clinical diagnosis of chronic obstruction at the duodenojejunal junction was made.

The patient came to the surgical side on February 16th, with the diagnosis of chronic or intermittent duodenal obstruction. Upon opening the abdomen through the right rectus muscle and lifting up the transverse colon a bulging downward of the duodenum was very apparent (Fig. 417, 2). No adhesions or ab-

CLINIC OF DR. J. P. GREENHILL

CHICAGO LYING-IN HOSPITAL

STENOSIS OF THE VAGINA

Summary: Classification of Stenoses of the Vagina. Etiology. Symptomatology. Treatment. Complications During Pregnancy. Report of a Case in Which Pregnancy Occurred Without Immissio Penis. Removal of the Stenosis During Pregnancy Permitting Coitus. Return of the Strictures after Delivery per Vaginum. A Second Successful Operation.

I SHOULD like to discuss with you today a fairly uncommon condition, namely, stenosis of the vagina. This condition is likewise called stricture of the vagina and atresia of the vagina. The term "stricture" is a proper synonym for stenosis, but the word atresia literally means a *complete* closure of a hollow organ. Despite this definition we often hear or read of *partial* atresias and, in accordance with common usage, I shall use the terms "stenosis," "stricture," and "atresia" interchangeably.

A brief classification of stenoses of the vagina is as follows:

CLASSIFICATION

Congenital {	Due to malformation or intra-uterine infection {	Usually associated with other deformities.
Acquired {	Premeno-pausal {	Infancy and childhood } Due to infection or injury.
		Reproductive period { Due to infection, obstetric trauma, gynecologic operations, and treatment
	Postmenopausal (senile vaginitis).	

Absence of the vagina

As the classification shows, stenosis of the vagina may be divided into two large groups, namely, congenital and acquired. The etiology of the congenital type is a matter of dispute. Some believe the atresia is due to congenital rests of a solid vaginal cord, while others assume an intra-uterine infection which produced agglutination of the walls of a normally developed vagina. Congenital stenoses are usually associated with other defects which involve the hymen, the uterus, the tubes, and the ovaries.

Acquired atresia is much more common than the congenital type and may be divided into two general groups, namely, premenopausal and postmenopausal. Premenopausal stenoses may be subdivided into those which occur during infancy and early childhood and those which arise during the reproductive period. During infancy and early childhood the etiology is usually an infection, but occasionally injury is the cause. The strictures which occur during the reproductive period are usually due to ulcerative processes which follow infectious diseases, the trauma of labor, or gynecologic operations and therapy.

Postmenopausal stenoses are usually due to chronic infections which readily occur in old age because of atrophy of the vaginal mucosa and the change in reaction of the vaginal secretions

COMPLETE ABSENCE OF VAGINA

Complete absence of the vagina does not in reality belong to the class of stenoses; because a vagina never was present to become atretic. However, since absence of the vagina is often grouped with atresias and stenoses we shall discuss this condition very briefly.

The chief importance of absence of the vagina as it concerns gynecologists is its treatment. Most of the patients who have no vagina are, except for the genitalia, physically and mentally normal individuals Those who would like to marry and fulfil their marital obligations often seek relief from their misfortune. There are practically only two types of operation employed to make a vagina, namely, the one which utilizes the small intestine (the Baldwin-Mori operation) and the one which employs a portion of the large intestine (the Schubert operation).

According to Wagner's[1] recent statement, there have been reported 61 operations of the Baldwin-Mori type with a mortality of 21 per cent., while of the 57 cases operated upon by the Schubert method there has not been a single death. However, since Wagner's report, Haim[2] has published a case report where death from peritonitis followed an operation in which the large bowel was used. From these figures you may see that the Schubert operation is by far the safer one.

Very rarely does one find an absence of the vagina with a normal uterus, tubes, and ovaries. However, 4 cases of this kind, where menstruating uteri were present, have been reported (Wagner,[3] Pitha,[4] and Schubert—two operations[5]). Wagner performed a Schubert operation on his patient and soon after the operation she became pregnant. At term the patient was delivered with forceps of a live baby. The episiotomy wound which had been made healed perfectly. This case demonstrates, therefore. that an artificial vagina in rare cases may be made to function not only for coitus but also for reproduction.

ETIOLOGY

Now to return to our main subject. It is commonly believed that the chief cause of atresia which occurs in childhood is vaginitis, due essentially to the gonococcus, although other organisms are frequently concerned. While in adults gonorrheal vaginitis is very unusual, the same does not apply to young children because in the latter the vaginal, stratified epithelium is very delicate. Epidemics of gonorrheal vaginitis in children's institutions are not infrequent. The profuse purulent discharge which these children have frequently shows other organisms besides the gonococcus and the discharge usually persists for a long time. These patients, however, seldom remember the vaginal discharge when questioned in later life. The ulcerated areas in the vagina produced by the infection heal by scar tissue or become adherent to one another and produce the strictures seen in adult life In mild cases the vagina may regain its previously normal condition. The standard treatment for vaginitis in children has been silver nitrate preparations, but

lately mercurochrome has come into competition with good results.

In addition to the purely local vaginitis there occasionally occurs a vaginitis as the result of a general infection, such as diphtheria, scarlet fever, measles, and debilitating diseases, in general In practically all the cases where vaginitis has occurred in childhood, the hymen is normal. I must here mention that Taussig[6] denies that vulvovaginitis produces stenosis of the vagina He believes the atresias found in later life are congenital and are discovered only when they cause some disturbance.

During the reproductive period the commonest cause of stenosis of the vagina is the traumatism of labor However, a fair number of cases have their etiology in strong chemicals, such as lysol, bichlorid of mercury, zinc chlorid, carbolic acid, etc, which have been introduced into the vagina. Some strictures are due to burns from exceptionally hot douches Plastic operations sometimes result in marked diminution in size of the vaginal lumen This not infrequently occurs when such operations are performed near the menopause because allowance is not made for the reduction in size of the vagina which occurs during the climacterium

Werner[7] reported a very rare cause of stenosis of the vagina. In a girl who presented a vaginal stricture, the cause was found to be a nervous spasm of the circular muscles about the vagina. This condition arose after coitus was forcibly attempted upon the patient and the spasm recurred each time a vaginal examination was made. An interesting phenomenon was the occurrence of the spasm in different parts of the vagina at different times The condition was cured by means of a faradic current There was a history of nervous disorders in a few members of the patient's family

SYMPTOMS

The onset of symptoms of stenosis of the vagina depends upon the time the cause acted Congenital cases associated with defective internal genitalia give no concern until the per-

sistent absence of the menses leads the patient to seek the help of a physician. In congenital cases of complete stenosis with normal internal genital organs and in those cases where the cause of the stricture acted during childhood, no symptoms result until puberty is reached. At this time the symptoms associated with retained menstrual blood present themselves. In the cases where menstrual blood can escape, the patient may not be aware of her condition until coitus is attempted. If a stenosis arises as the result of the trauma of childbirth, the patient may become aware of the condition by dyspareunia or by dystocia in a subsequent labor. In the cases where the atresia has been produced not by childbirth but by an infection or by chemical or thermic agents, the condition makes itself known by increasing dyspareunia. In senile stenosis there are few symptoms other than dyspareunia, but pruritus vulvæ is often present and is probably due to the concomitant senile vaginitis.

TREATMENT

Here, as everywhere else in medicine in a discussion of therapy, prophylaxis must be considered At present we know absolutely no way of preventing congenital defects. For vaginitis in children early and vigorous treatment with isolation of infected children is essential. Further aids in reducing the number of acquired stenoses are the reduction of obstetric trauma to a minimum, care in doing plastic operations on the vagina and in applying medication or recommending treatment and education concerning the dangers of strong douches.

Patients who have no vagina and who seek aid should be informed of the risks involved and the one thing to be gained by the operation. Should marriage be contemplated the patient should be told that she or some one else ought to tell the fiancé that child-bearing is impossible, unless the patient is one of the rare individuals who has normal internal genitalia.

For patients with complete stenosis of the vagina in the presence of a normal uterus, the stenotic area should be excised as completely as possible and the raw surfaces covered with contiguous vaginal mucosa or portions of the labia minora. A

pack saturated with vaselin should be inserted into the vagina
to keep the surfaces apart and this should be left for a number
of days. After this, plain douches should be given twice daily,
because there is usually a profuse discharge from the vagina
Gentle dilatation will usually be required at frequent intervals
after the operation to prevent circular contraction of the new
scars. A very ingenious operation for complete atresia was
devised recently by Grad[8] A patient whose uterus and cervix
had been treated with nitric acid and who has been very sick
following this, was later found to have a complete atresia in the
vault of the vagina as a result of the application of the acid.
The cervix could not be palpated, but the uterus was enlarged
and the adnexa were apparently normal. The scar in the vaginal
vault was excised, after which dark blood escaped The cervix
was dug out of its adherent position and pulled through the
newly made incision in the stenotic scar. The vaginal mucosa
in front of the scar was then sutured to the cervix The wound
healed perfectly Later Ward[7] performed this operation on a
patient of his and also had a successful result

In cases of partial stenosis an attempt should be made to
excise as much of the scar tissue as possible The vagina should
then be stretched digitally Where possible to do so without
encroaching upon the lumen of the vagina, the raw areas should
be covered with mucosa or portions of the labia minora As
before mentioned, the vagina should be tightly packed and the
packing should be left in the vagina for a number of days. The
removal of the pack is to be followed by douches Gradual
dilatation with the fingers or glass dilators will usually be neces-
sary to prevent a recurrence of the constriction. Even with
repeated dilatations a partial return of the strictures will be
found in many patients if they are examined a number of months
after operation. Ries[10] recently reported 2 cases of stricture
of the vagina, in both of which the strictured areas were excised
and the raw mucosal edges approximated with catgut. No pack
was used in these patients and in both the result was highly
satisfactory One of these patients had had diphtheria in
childhood

COMPLICATIONS DURING PREGNANCY

Patients with partial stenoses not infrequently become pregnant and go to term, but many have dystocia. Neugebauer[11] reviewed 1000 cases of stenosis of the vagina, among which there were 303 cases of parturient women. Of the latter, 35 were delivered by a conservative cesarean section, 23 by a Porro operation, and 245 had vaginal deliveries. Of the latter, 91 had spontaneous deliveries after previous operations; but all the others had very great dystocia. *In most of the patients delivered vaginally there was a return of the stenosis, or injuries, such as fistulæ, resulted.* Only a minority escaped without complications, hence the prognosis is bad when vaginal delivery is attempted in these cases. The mortality in the 245 cases delivered *per vias naturales* was 10.55 per cent., which is indeed appalling. Neugebauer also reported many cases where, even after operation to relieve the stenosis, delivery from below caused much trouble, and the damage which resulted entailed new operative procedures.

In the cases where atresia is complete it would appear that conception is out of the question. That conception, however, is possible in the presence of a co-existing *complete* atresia of the vagina is proved by the exceptional case reported by Montini[12] of a patient who had a complete atresia of the vagina, but who had at the same time a vesicovaginal fistula. Coitus took place through the urethra and the sperm reached the internal genitalia by means of the vesicovaginal fistula. At term a Porro operation was done on this patient. Stanca[13] also reports a case of complete atresia of the vagina where coitus was consummated *per urethrum.* The urethra in his patient was 3 cm. long and admitted a No. 20 Hager dilator. Despite this, the patient did not have incontinence of urine.

AUTHOR'S CASE

The case which I should like to present to you presents a number of interesting points. On October 14, 1922 Mrs. M. F., age twenty-six, came to see me because of inability to have sexual intercourse. She had been married four and one-half

months and while numerous attempts had been made, her husband could not succeed in entering the vagina. Of importance in the patient's past history was the fact that she had had diphtheria twice, once in childhood and once at the age of twenty-one. She had frequent attacks of tonsillitis and at the age of twenty underwent a thyroidectomy. At fourteen the patient experienced cramp-like pains in the lower abdomen every month, but no blood escaped from the vagina. A physician was consulted and the patient said he inserted a finger into the vagina and broke something After this, bleeding occurred regularly every month and was accompanied by very little discomfort.

Let us pause here for a moment and consider this history From the patient's complaint, namely, inability to have sexual intercourse, we might assume there was either absence of the vagina, an imperforate hymen, a congenitally tight vagina, a stenosis of the vagina, marked nervousness and fear on the part of the patient, or ignorance of the physiology involved in the mechanism of coitus. The information concerning the rupture by a physician of something in the vagina, after which the pains which occurred every month disappeared and instead blood escaped from the vagina, enables us to eliminate the idea of an absent vagina and indicates that either an imperforate hymen or a complete stenosis of the vagina had been present at puberty The history of diphtheria in childhood is an important aid because diphtheria, as I said before, may result in atresia of the vagina The patient did not recall ever having had a vaginal discharge in childhood, but exceedingly few patients who have had a vaginal discharge in childhood remember it in later life. Thus from the history alone we come to a tentative conclusion that Mrs. F. has an acquired stenosis of the vagina and that this is the cause of the dyspareunia We have not, however, eliminated as possible causes nervousness and ignorance

The patient said she had not menstruated for almost three months before coming to see me, but she did not remember the exact dates. Questioning elicited the information that the breasts had grown larger during the preceding weeks, the abdomen felt larger and there was increased salivation. Here,

then, was presumptive evidence that a pregnancy existed. A question immediately presents itself. Can a woman become pregnant even if coitus had never been consummated? The answer is, yes—decidedly yes—and this fact is of great importance in certain medicolegal cases. There is no doubt that in some women pregnancy can occur after deposition of sperm on the vulva (especially the introitus) even if none have been ejaculated into the vagina. Kisch[14] reported twenty-five cases of pregnancy which occurred in the presence of an unruptured hymen from 1672 to 1885. Recently cases of this kind have been reported by Gál,[15] Flechtenmacher,[16] and van Tongeren.[17] In all 3 cases in the presence of a pregnancy there was vaginismus and the hymenal orifice would not permit the entrance of a finger, thereby excluding the possibility of immissio penis. In the most recent case reported by Bischoff[18] there was no vaginismus.

Physical examination of Mrs. F. revealed a frail woman, 5 feet tall, weighing 104 pounds. The important findings were defective teeth, a scar on the neck from the thyroidectomy, small breasts from which colostrum could not be expressed, a thin scaphoid abdomen with the uterus palpable, and marked varicose veins on both thighs and legs. The blood-pressure was 102 mm. Hg. systolic and 68 mm. Hg. diastolic and the urine showed no abnormal findings. Pelvic examination was as follows: The labia majora and minora were normal and there was abundant pubic hair. The hymen was sensitive and the orifice admitted one finger for a distance of 2 cm. beyond which there was a tense stenotic ring of scar tissue. This ring could not be penetrated by the finger. A rectal examination revealed not only this circular band, but also similar ones higher up. The cervix which was high up and difficult to outline seemed to be buried in adhesions above the vault rather than in the vault of the vagina. The uterus was enlarged to the size of a ten weeks' pregnancy, it was soft, anteflexed, and freely movable. The adnexa presented no abnormalities.

The patient and her husband at first refused to believe that a pregnancy existed, but despite that fact wanted something

done so that coitus could be made possible. Accordingly, on October 16th the following was done: Under ether anesthesia a vaginal examination was made, but the examining finger could proceed no further in the vagina than when the patient was awake. The hymenal ring was first excised. Then the first strong band of scar tissue was incised, some of the scar tissue was removed and the cut portions stretched considerably with my fingers. Access was now obtained to the upper scars, of which there were many and these were very irregular. These scars were likewise incised in a few places and forcibly stretched. After this was done the vagina admitted three fingers very readily. The vault was exposed in the expectation of seeing the cervix. It was with great difficulty that the external os, which measured about 2 mm., was found and it was flush with the vaginal mucosa. The entire cervix was buried in tissue above the vault. During the operation numerous large veins were encountered. The cut edges of the mucosa in the first tense circular bands were approximated with interrupted catgut sutures perpendicularly to the lines of incision and then the vagina was tightly packed with gauze saturated with vaselin. No difficulty in urination was experienced because of the vaginal pack which was removed two days after the operation. Three days after this the patient was discharged from the hospital. Ten days later in making a vaginal examination, while the very strong circular band, the first one to be incised, was palpable, I could insert two fingers to the vaginal vault without causing any pain. However, the vagina was stretched digitally until three fingers could be inserted. The uterus had now attained the size of a twelve weeks' pregnancy. On November 14th the patient returned for her complete obstetric examination and the vagina admitted two fingers all the way without difficulty. The vagina was again stretched.

The external pelvic measurements were interspinous 24 cm., intercristous 26 5 cm., bitrochanteric 30 cm., and Baudeloque 17.5 cm. The diagonal conjugate measured 10 cm. The patient was permitted to have intercourse. This was accomplished without much discomfort. On December 5th Mrs. F. returned for

her routine obstetric visit and complained of dyspareunia again. She said her husband was very impatient and hurt her a good deal. On making a vaginal examination it was found that the first strong circular band was more constricted than it had been at the last visit but still admitted two fingers. This band was again stretched forcibly until three fingers could be inserted. Then a cotton kite-tail tampon was packed into the vagina and left for twenty-four hours. After that coitus caused no discomfort. Subsequent examinations, however, revealed the enlargement of many veins in the vaginal mucosa and in the vulva so that they soon evidenced themselves as large, dilated, and tortuous varicose veins. Because of these varicose veins, because of the small pelvis, and because of the fear of a recurrence of the stenosis of the vagina, if delivery were attempted below, it was decided to perform a cesarean section when the patient went into labor.

During my absence Dr. Horner looked after Mrs F. On May 5th the patient presented herself in the second stage of labor. Preparations were made for a cesarean section, but before things were ready the fetal head was found to be well engaged. The child was, therefore, delivered with forceps after an episiotomy had been made. There was a great deal of bleeding from the veins in the vagina and from the episiotomy wound, but this soon stopped. The baby weighed 3125 grams (6 pounds, 14 ounces). The patient made an uneventful recovery and left the hospital on May 14th.

When Mrs. F. returned for the customary examination six weeks after leaving the hospital, examination showed that the episiotomy wound had healed very well, but that the vagina was full of irregular adhesions again. Not more than one finger could be admitted into the vagina and that only for a distance of 2 cm. Beyond this point was a very dense circular stricture, the opening in which measured about $\frac{1}{2}$ cm. in diameter. On rectal examination more circular bands were felt higher up in the vagina. The cervix was very small and firm and the uterus, which was of normal size and consistency, was anteflexed. The adnexa showed no abnormalities.

The patient refused to have anything done, but returned several months later because her husband threatened to leave her if something were not done to enable him to have intercourse On February 13, 1924, therefore, I performed a second plastic operation under ether Three successive tense circular constrictions were encountered and cut across anteroposteriorly in several places and portions of these scars were excised. The mucosa over most of the vagina was friable and contained varicose veins. The vagina was stretched digitally until four fingers were accommodated. After this the entire vaginal mucosa was well lubricated with sterile vaselin and a rubber glove with the fingers tied off and inverted was placed in the vagina The glove was then packed very tightly with a large number of cotton pledgets and a purse-string suture was placed around the cuff of the glove to keep the pledgets within the glove. For two days following the operation the patient had to be catheterized because of the large amount of packing in the vagina On the third day some of the cotton pledgets were removed, after which the patient voided spontaneously. The rest of the packing was removed on the sixth day. It was originally intended to leave the tampon in the vagina for seven days, but because the patient's temperature went up to 100.6° F on the sixth day the pack was removed on that day The temperature was normal a few hours after the pack was removed and remained normal. After withdrawing the pack I made a vaginal examination and was frightened at the capacity of the vagina My fingers went so far up that I thought at first they were free in the peritoneal cavity. Boric acid douches were given twice daily after removal of the tampon and nine days after the operation the patient left the hospital feeling perfectly well. At this time a vaginal examination showed a very spacious vagina which admitted three fingers readily without any discomfort. The patient returned six days later and at this time the vagina admitted two fingers with ease, but three fingers caused a little pain. The vagina was lubricated and gently dilated with the fingers and then with a series of glass dilators. The distance from the introitus to the vaginal vault measured 11 cm. (without being stretched) whereas

it had never before measured more than 7 cm. There were a few irregular thin adhesions in the uppermost portions of the vagina and these were severed digitally.

Another examination two weeks later revealed a spacious vagina, but not as roomy as it had been at the last examination. Again the vagina was stretched with glass dilators. The patient's husband was very impatient, so coitus was permitted. Much to the satisfaction of both the patient and her husband everything went along very well and the couple were very happy after that.

I thought that Mrs. F.'s troubles were over, for I did not hear from her for many months. However, on August 26, 1924, Mrs. F. returned looking quite forlorn. She had lost a great deal of weight for she now weighed only 86 pounds. Inquiry elicited the fact that she had not had intercourse for a number of months. I naturally assumed a recurrence of the atresia with consequent dyspareunia, but Mrs. F. said that was not the cause of her depression. She had a gruesome fear of becoming pregnant again. This worried her considerably and she and her husband quarreled incessantly because Mrs F. refused to have intercourse. I made a vaginal examination and found that two fingers could easily be introduced into the vagina for a distance of about 8 cm., at which point there was a moderate circular constriction. After stretching this constriction slightly, the two fingers were made to pass. The cervix as before could not be felt. Mrs. F. was referred to an internist to see if there might be any cause other than the mental one for the marked loss in weight and run-down condition. The internist failed to find any organic cause so I resorted to psychotherapy with good results. In December, 1924 the patient returned looking very well. She had gained weight and was feeling happy. Marital relations were being indulged in normally and without any pain whatever. I saw Mrs. F. again in March, 1925, and she was in the best of spirits. She wants to have another baby soon but insists that I promise to do a cesarean section to avoid a recurrence of the condition which caused her so much unhappiness.

SUMMARY

To review this interesting case briefly, we have a patient who had diphtheria in childhood and during adolescence and most likely had a vaginitis in childhood as a complication of the diphtheria. The vaginitis resulted in a complete atresia of the vagina. At puberty molimenal symptoms were present, but no flow of blood. A physician broke something in the vagina and menstruation was normal after that. The patient then had no trouble until she married when she found she could not indulge in coitus. When first seen by me she was about ten weeks pregnant despite the fact that the penis had not entered the vagina. An operation was performed during pregnancy in which some irregular bands of scar tissue were incised and others excised and a functionating vagina resulted. As pregnancy progressed, varicose veins in the vagina became more and more conspicuous and because of this and the fear of a repetition of the stenosis, it was decided to perform a cesarean section at term. However, the patient did not notify any one until she was in the second stage of labor and at that time the head was well engaged. Delivery was accomplished with forceps. After childbirth the old stenosis recurred, but was more pronounced. A second operation was performed and again the vagina was restored to a condition which caused satisfaction to the patient and her husband.

The patient demands a cesarean section as the only means of delivery of her next baby. I do not hesitate to say that I shall readily acquiesce to this demand for I believe a cesarean section is the best procedure not only for cases of marked stenosis of the vagina but also for patients who have been successfully operated on for this condition. My choice of operation is the transperitoneal cervical cesarean section (laparotrachelotomy).

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